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Volume III

User's Manual

October 1973

SRB Water Impact Loads Computer Program

Space Shuttle Solid Rocket Booster Recovery System Definition

MARTIN MARIETTA

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SRB Water Impact
Loads
Computer Program

SPACE SHUTTLE
SOLID ROCKET BOOSTER
RECOVERY SYSTEM
DEFINITION

Approved

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FOREWORD

This report is submitted in three volumes to the National Aeronautics and Space Administration, Marshall Space Flight Center, in partial fulfillment of the requirements of Contract NAS8-29622.

The objective of this contractual effort has been to define performance requirements, preliminary designs, and development program plans for an airborne recovery system for the Space Shuttle Solid Rocket Booster, with minimum total program costs being the primary selection criterion.

Volume I, entitled *Technical Report, Space Shuttle Solid Rocket Booster Recovery System Definition,* contains the results of all analyses performed during the study term to define the performance requirements, preliminary designs, and development program plans for the SRB Recovery Subsystem.

Volumes II and III contain user's instructions for two computer programs developed in support of the contract technical studies. Volume II is entitled *Solid Rocket Booster Water Impact Monte Carlo Computer Program* and Volume III is entitled *Solid Rocket Booster Water Impact Loads Computer Program.*

CONTENTS

Figure

Output Listings

SUMMARY

This user's manual describes the FORTRAN IV computer program developed to compute the total vertical load, normal concentrated pressure loads, and the center of pressure of typical SRB water impact slapdown pressure distributions specified in the baseline configuration, *Preliminary Water Impact Loads for the Space Shuttle Solid Rocket Booster (SRB)*, dated 11 April, 1973.

The program prepares the concentrated pressure load information in punched card format suitable for input to the STAGS computer program. In addition, the program prepares for STAGS input the inertia reacting loads to the slapdown pressure distributions.

NOMENCLATURE

```
C A         DEGREE TO RADIAN CONVERSION
C ANGLE     180 LESS INCLUSIVE ANGLE/2 OVER WHICH REACTING STRAP BEARS
C ANIL      NORMAL INERTIA LOAD COMPONENT AT A NODE
C ANL       NORMAL LOAD AT MESH POINT
C ATIL      TANGENTIAL INERTIA LOAD COMPONENT AT A NODE
C AVL       VERTICAL COMPONENT OF NORMAL LOAD
C AWA       WETTED ANGLE AT MESH POINT
C CP        CENTER OF PRESSURE
C CPR       RADIAL PRESSURE DISTRIBUTION CURVE 2 (WETTED ANGLE EQUAL 90)
C CWSR      WETTED SURFACE RATIO OF YCORD IN MESH
C D         VEHICLE DIAMETER
C DC        INCREMENTAL LENGTH IN SEGMENT Y
C DCPR      INCREMENTAL PRESSURE RATIO FOR CURVE 2
C DHPR      INCREMENTAL PRESSURE RATIO FOR CURVE 1
C DL        INCREMENTAL LENGTH IN SEGMENT X
C DPN       INCREMENTAL PRESSURE
C DVSD      INCREMENTAL VEHICLE STATION
C DWA       INCREMENTAL WETTED ANGLE
C DWSR      INCREMENTAL WETTED SURFACE RATIO
C DX        INCREMENTAL DISTANCE ALONG X COORDINATE
C DY        INCREMENTAL DISTANCE ALONG Y COORDINATE
C HC        PORTION OF VEHICLE CIRCUMFERENCE
C HPR       RADIAL PRESSURE DISTRIBUTION CURVE 1 (WETTED ANGLE LESS 90)
C HV        HORIZONTAL VELOCITY
C KO        CODE FOR DESIRED OUTPUT (0,1, OR 2)
C LA        CODE FOR SHAPE OF PRESSURE CURVE (0 OR 1)
C LP        CODE FOR SHAPE OF WETTED ANGLE CURVE (0 OR 1)
C NC        NUMBER OF COLUMNS ALONG Y COORDINATE DIRECTION
C NCDP      NUMBER OF CIRCUMFERENTIAL DATA POINTS FOR PRESSURE
C NLDP      NUMBER OF LONGITUDINAL DATA POINTS FOR KEEL PRESSURE
C NNX       NUMBER OF SEGMENTS IN X DIRECTION WITH CONSTANT SPACING
C NNY       NUMBER OF SEGMENTS IN Y DIRECTION WITH CONSTANT SPACING
C NR        NUMBER OF ROWS ALONG X COORDINATE DIRECTION
C NSEGX     NUMBER OF MESH SPACES WITHIN SEGMENT X
C NSEGY     NUMBER OF MESH SPACES WITHIN SEGMENT Y
C PCR       PRESSURE RATIO OF YCORD IN MESH AT A LONGITUDINAL STATION
C PI        PI
C PL        PRESSURE AT YCORD IN MESH
C PMAX      MAXIMUM PRESSURE
C PN        NORMALIZED PRESSURE AT A VEHICLE STATION
C R         VEHICLE RADIUS
C REACT     UNIFORM STRAP BEARING LOAD AT A LONGITUDINAL STATION
C RL        AVERAGE PEAK RUNNING LOAD AT A LONGITUDINAL STATION
C SEGLX     LENGTH OF SEGMENT IN X DIRECTION
C SEGLY     ANGLE OF SEGMENT IN Y DIRECTION
C STRAP     STRAP TENSION LOAD AT A LONGITUDINAL STATION
C STVIL     TOTAL VERTICAL INERTIA LOAD ON VEHICLE
C STVL      HALF OF TOTAL VERTICAL PRESSURE LOAD ON VEHICLE
C STVLXC    TOTAL FIRST MOMENT OF VERTICAL PRESSURE LOAD ON VEHICLE
C S2TVL     TOTAL VERTICAL LOAD ON VEHICLE DUE TO PRESSURE
C T         TIME POINT NUMBER
C THETA     INCLUSIVE ANGLE USED IN VEHICLE MODEL (90 OR 180)
C TL        TOTAL X LENGTH
C TNT       TOTAL NUMBER OF TIME POINTS
C TVIL      TOTAL VERTICAL INERTIA LOAD AT A VEHICLE STATION
C TVL       TOTAL VERTICAL PRESSURE LOAD AT A VEHICLE STATION
C TVLXC     FIRST MOMENT OF TOTAL VERTICAL PRESSURE LOAD AT A STATION
```

NOMENCLATURE(CON-TD)

```
C UB        UNBALANCE BETWEEN PRESSURE AND INERTIA LOADING
C VIL       VERTICAL INERTIA LOAD AT A MESH POINT
C VL        VEHICLE LENGTH
C VSD       NON*DIMENSIONAL VEHICLE STATION IN DIAMETERS
C VV        VERTICAL VELOCITY
C WA        WETTED ANGLE AT A VEHICLE STATION
C WSR       WETTED SURFACE RATIO
C XCORD     X-COORDINATE OF MESH POINT
C XPN       MAX PRESSURE AT A ROW IN MESH
C XWA       AVERAGE WETTED ANGLE AT A ROW IN MESH
C YCORD     Y-COORDINATE OF MESH POINT
```

1.0 PROGRAM DESCRIPTION

The program is designed to prepare point load cards that are representative of an arbitrary SRB water impact slapdown pressure distribution. The punched load cards are in a format compatible for use in the STAGS shell analysis program.

The program will compute in a single run the loads for an unlimited quantity of slapdown pressure distributions on any size vehicle.

The program utilizes as part of its input mesh definition cards identical to those required for STAGS input. The program then generates for an arbitrary mesh the normal point loads representative of the slapdown pressure distribution. In addition, the total vertical load and its center of pressure (relative to the initial vehicle station) on the vehicle are calculated.

The inertia reacting loads are calculated so as to balance the total vertical pressure load at each incremental vehicle station. The net normal and tangential load components are then computed for each mesh point in a format compatible for use in the STAGS computer program.

There are essentially 16 steps required to obtain a set of loads for each time point or slapdown pressure distribution. These are:

1) reading data points required to describe the normalized pressure and wetted angle curves;

2) reading data to describe each time point and vehicle parameter;

3) dimensionalizing pressure versus vehicle station curve;

4) calculation or reading of X-coordinate data;

5) calculation or reading of Y-coordinate data;

6) calculation of increments in vehicle length, pressure, and wetted angle data;

7) calculation of maximum pressure and wetted angle for each X-coordinate in mesh;

8) calculation of average peak running load for each X-coordinate in mesh;

9) calculation of average wetted angle for each X-coordinate in mesh;

10) calculation of incremental values for the two nondimensional radial pressure distribution curves;

11) calculation of wetted surface ratio, pressure ratio, and value of radial pressure loading at each mesh point;

12) calculation of equivalent normal pressure load and its vertical component at each mesh point and the total vertical pressure load for each incremental longitudinal station;

13) calculation of vertical inertia load and its normal and tangential component at each mesh point and the total vertical inertia load (equal and opposite to the total vertical pressure load) for each incremental longitudinal station;

14) calculation of net normal and tangential load components at each mesh point;

15) calculation of total vertical pressure load, its center of pressure, and any unbalance between the total vertical pressure and inertia load;

16) punched or written output of the net normal and tangential load components for each mesh point.

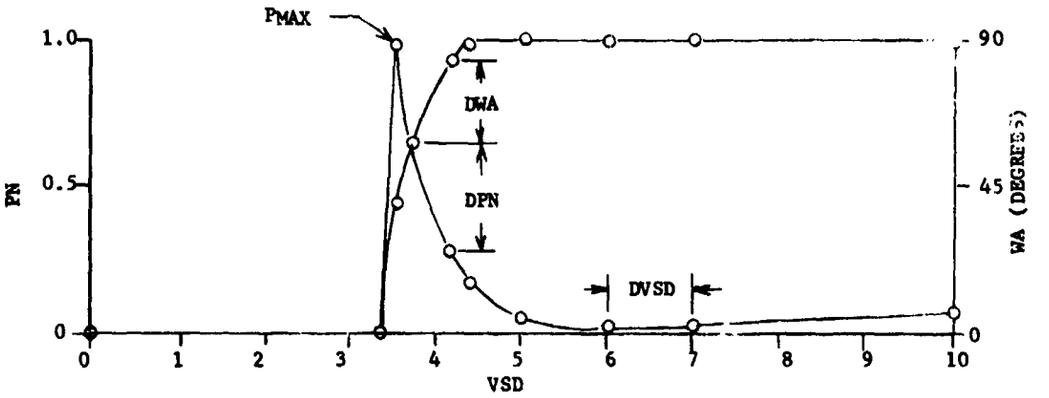
2.0 GENERAL NOTES

A portion of the program nomenclature is illustrated in Figures 2-1 and 2-2. The program assumes collapse pressures to be positive in value, and the vehicle model coordinate system to be as noted in Figure 2-2.

Since the program uses a linear integration scheme, the accuracy in the loads data will generally be a function of the mesh density. (Loads generally are more accurate for a denser mesh.) Also, to further improve the accuracy, the normalized data points used to describe the keel pressure and wetted angle curves should have the same vehicle station or X-coordinate as a mesh point. In addition, the LA-LP option code allows either a tapered or stepped shaped wetted angle and keel pressure distribution curve to be used. (See Example Problems 1 and 2.)

The program will use up to two normalized radial pressure distribution curves. Curve 1 should be used if the wetted angles are less than 90 deg, and Curve 2 should be used if the wetted angles are equal to 90 deg.

Depending upon the specified value of KO, the program will then calculate only the normal pressure loads, the net pressure and uniform inertia relief loads, or the normal pressure loads and the reacting strap normal bearing loads.



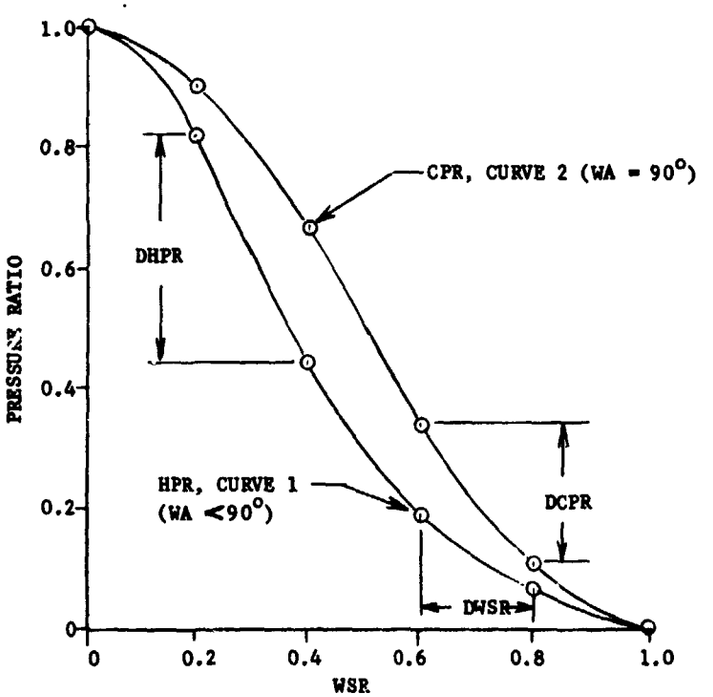


Figure 2-1 Program Nomenclature for the Normalized Pressure and Wetted Angle Curves

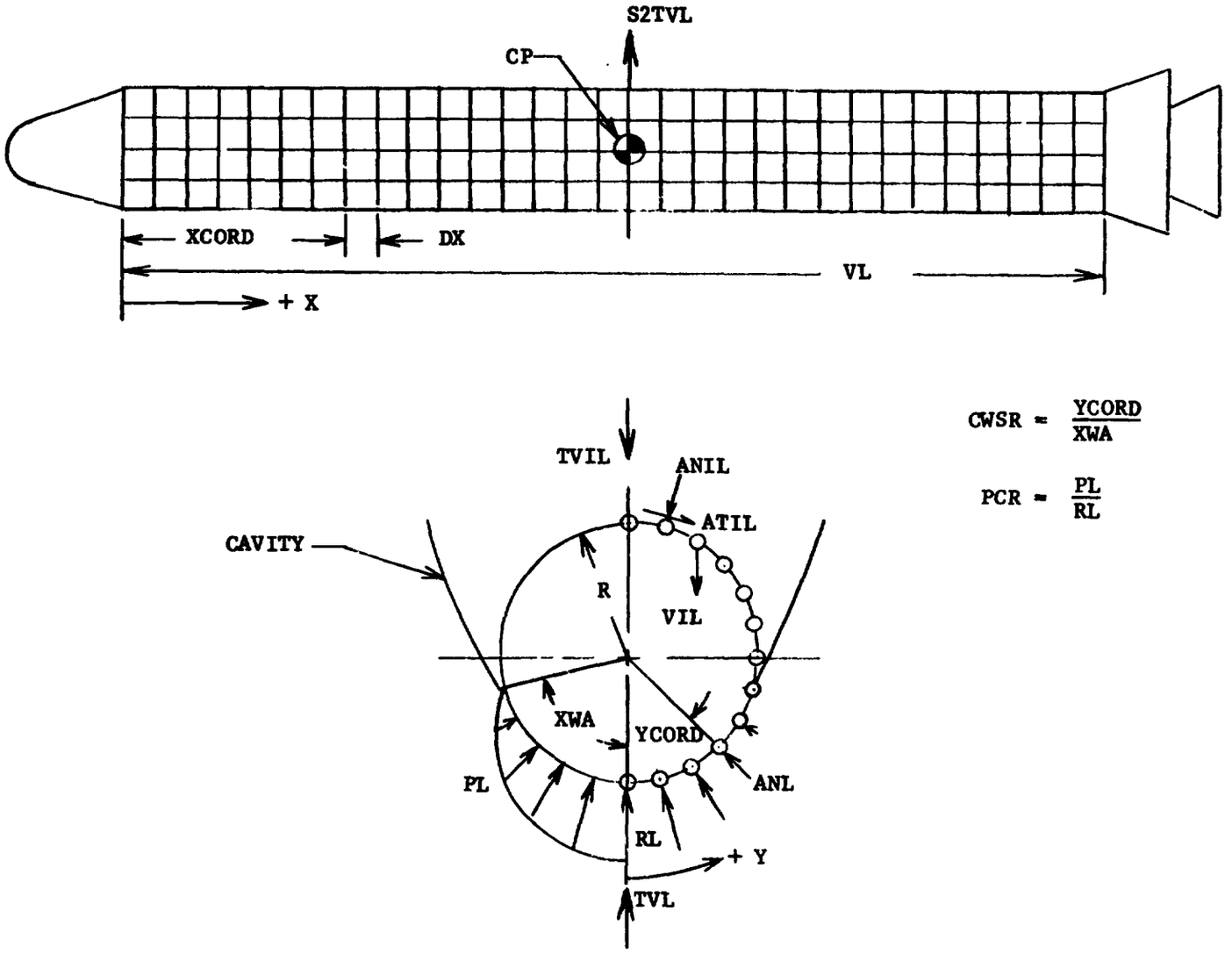


Figure 2-2 Program Nomenclature for the Vehicle Parameters and Load Calculations

3.0 DATA CARDS

As basic input data for each pressure distribution or time point, the following data cards are required.

For Each Run

1) Total number of time points or pressure distributions (REQUIRED);

For Each Time Point

1) Number of data points (20 max) required to properly define the normalized keel slapdown pressure distribution and wetted angle curves as a function of the normalized vehicle station, and the number of data points (20 max) required to define the two normalized radial slapdown pressure distribution curves (REQUIRED);

2) Maximum keel pressure and wetted angle versus X-station curve data (REQUIRED);

3) Radial pressure ratio versus wetted surface ratio curve data (REQUIRED);

4) Value of maximum slapdown pressure, number of time points, vertical and horizontal velocity, vehicle radius and length, and total angle used in STAGS model (REQUIRED);

5) Number of rows (100 max) and columns (37 max) in mesh (REQUIRED);

6) X-coordinate cards (OPTIONAL);

7) X-segment card (OPTIONAL);

8) X-segment lengths definition cards (OPTIONAL);

9) X-segment spacing definition cards (OPTIONAL);

10) Y-coordinate cards (OPTIONAL);

11) Y-segment card (OPTIONAL);

12) Y-segment lengths definition cards (OPTIONAL);

13) Y-segment spacing definition cards (OPTIONAL).

3.1 INSTRUCTIONS FOR CODING CARDS

For Each Run

1) Control card
Format (F10.5)

*CCN	1 10
	TNT

For Each Time Point

1) Control card for slapdown pressure and wetted angle curves and type of punched output desired.
Format (5I5)

CCN	1 5	6 10	11 15	16 20	21 25
	NLDP (20 max)	NCDP (20 max)	LA	LP	KO

LA = code for shape of wetted angle curve
0 = tapered loading
1 = stepped loading

LP = code for shape of pressure curve
0 = tapered loading
1 = stepped loading

KO = code for punched loads output
0 = normal pressure loads only
1 = net pressure and uniform inertia relief loads
2 = normal pressure and strap bearing loads

2) Keel pressure and wetted angle versus X-station curve data
Format (6 F10.5)

CCN	1 10	11 20	21 30	31 40	41 50	51 60
	VSD	WA	PN	VSD	WA	PN

---

*CCN stands for card column number

3) Radial pressure ratio versus wetted surface ratio curve data
Format (6 F10.5)

CCN	1 10	11 20	21 30	31 40	41 50	51 60
	WSR	HPR	CPR	WSR	HPR	CPR

4) Pressure, time point, velocity, and vehicle data
Format (8 F10.5)

CCN	1 10	11 20	21 30	31 40	41 50	51 60	61 70	71 80
	PMAX	T	VV	HV	R	VL	THETA	ANGLE

5) Control card defining mesh size
Format (215)

CCN	1 5	6 10
	NR (100 max)	NC (37 max)

6) X-coordinate data
Format (8E10.6)

CCN	1 10	11 20	21 30	31 40	41 50	51 60	61 70	71 80
	XCORD	XCORD	XCORD	XCORD	XCORD	XCORD	XCORD	XCORD

7) Control card for X-segments
Format (I5)

CCN	1 5
	NNX

8) X-segment length data
Format (8E10.6)

CCN	1 10	11 20	21 30	31 40	41 50	51 60	61 70
	SEGLX	SEGLX	SEGLX	SEGLX	SEGLX	SEGLX	SEGLX

71 80
SEGLX

9) X-segment spacing data
Format (16I5)

CCN	1 5	6 10	11 15	
	NSEGX	NSEGX	NSEGX	etc

10) Y-coordinate data
Format (8E10.6)

CCN	1 10	11 20	31 30	31 40	41 50	51 60	61 70
	YCORD	YCORD	YCORD	YCORD	YCORD	YCORD	YCORD

71 80
YCORD

11) Control card for Y-segments
Format (I5)

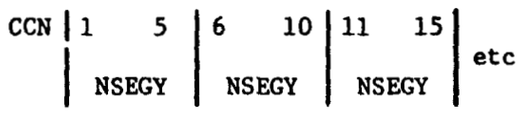
CCN	1 5
	NNY

12) Y-segment length data
Format (8E10.6)

CCN	1 10	11 20	21 30	31 40	41 50	51 60	61 70
	SEGLY	SEGLY	SEGLY	SEGLY	SEGLY	SEGLY	SEGLY

71 80
SEGLY

13) Y-segment spacing data
Format (16I5)



4.0 SAMPLE PROBLEMS

The following sample problems are given to illustrate the input and output of the water impact loads program.

4.1 SAMPLE PROBLEM 1

The problem was designed to show the input and partial output for a keel slapdown pressure distribution typical of those shown in the baseline water impact loads document (4/11/73). The normalized pressure and wetted angle curves are shown in Figures 4-1 and 4-2.

4.2 SAMPLE PROBLEM 2

The problem was chosen to illustrate the input and partial output for a keel slapdown pressure distribution like that simulated on the 120-in. diameter test specimen. The normalized pressure and wetted angle curves are shown in Figures 4-3 and 4-4.

4.3 PROGRAM LISTING

A complete listing of the FORTRAN IV program is given to aid in illustrating the integration steps used to obtain a set of loads.

4.4 THREE SUPPLEMENTAL PROBLEMS

Three supplemental problems were also run to generate the punched load cards representative of a slapdown pressure distribution of the same general shape as that simulated on the 120-in. diameter test specimen. However, the peak pressures were reduced from those in Sample Problem 2 and the location of the distribution was varied. (See listing of input data cards on page 65. For a listing of the normal concentrated pressure loads for each supplemental problem, see page 66.) The punched cards are in a format suitable for use in the 90-deg STAGS model of the 120-in. diameter static test specimen. In addition, the total vertical pressure load and its center of pressure are punched as a card for each distribution.

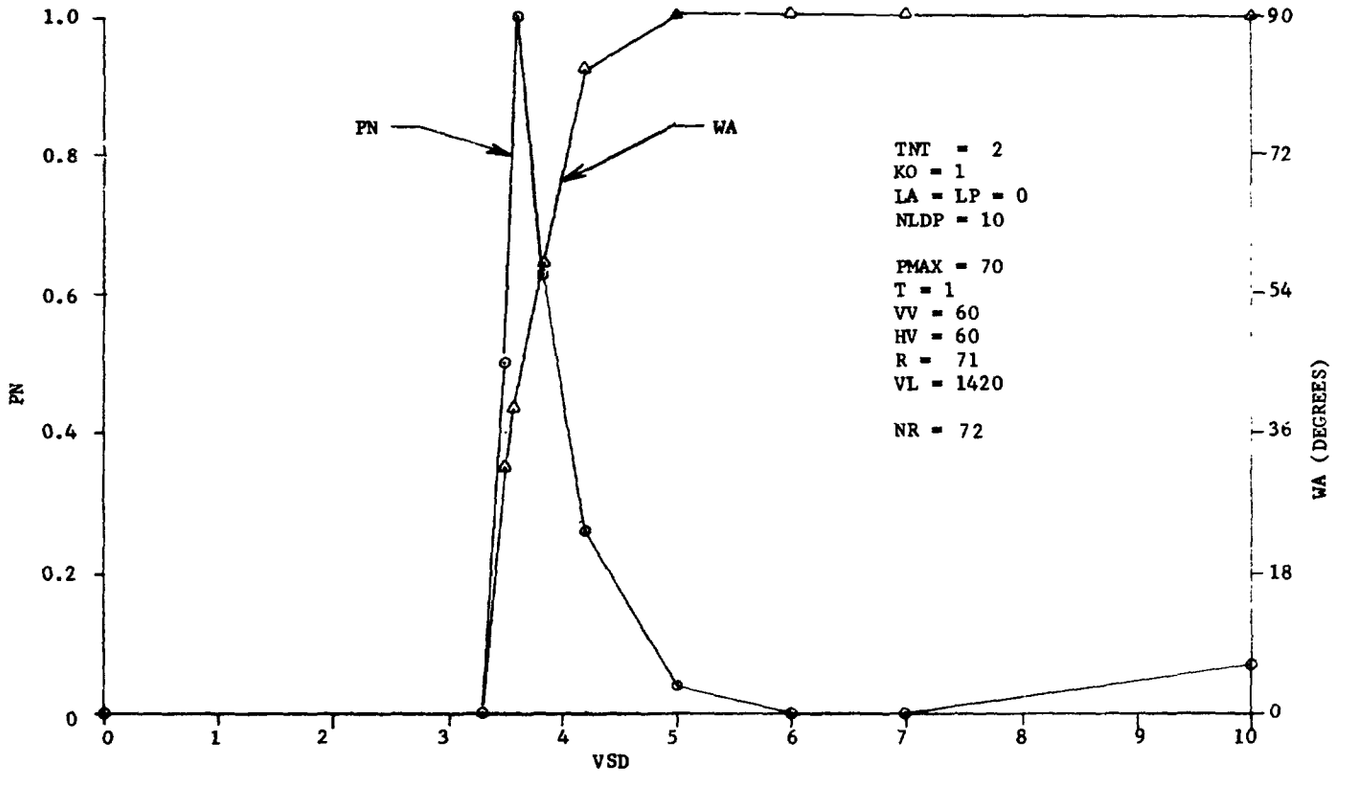


Figure 4-1 Normalized Keel Pressure and Wetted Angle Distribution for Example Problem 1

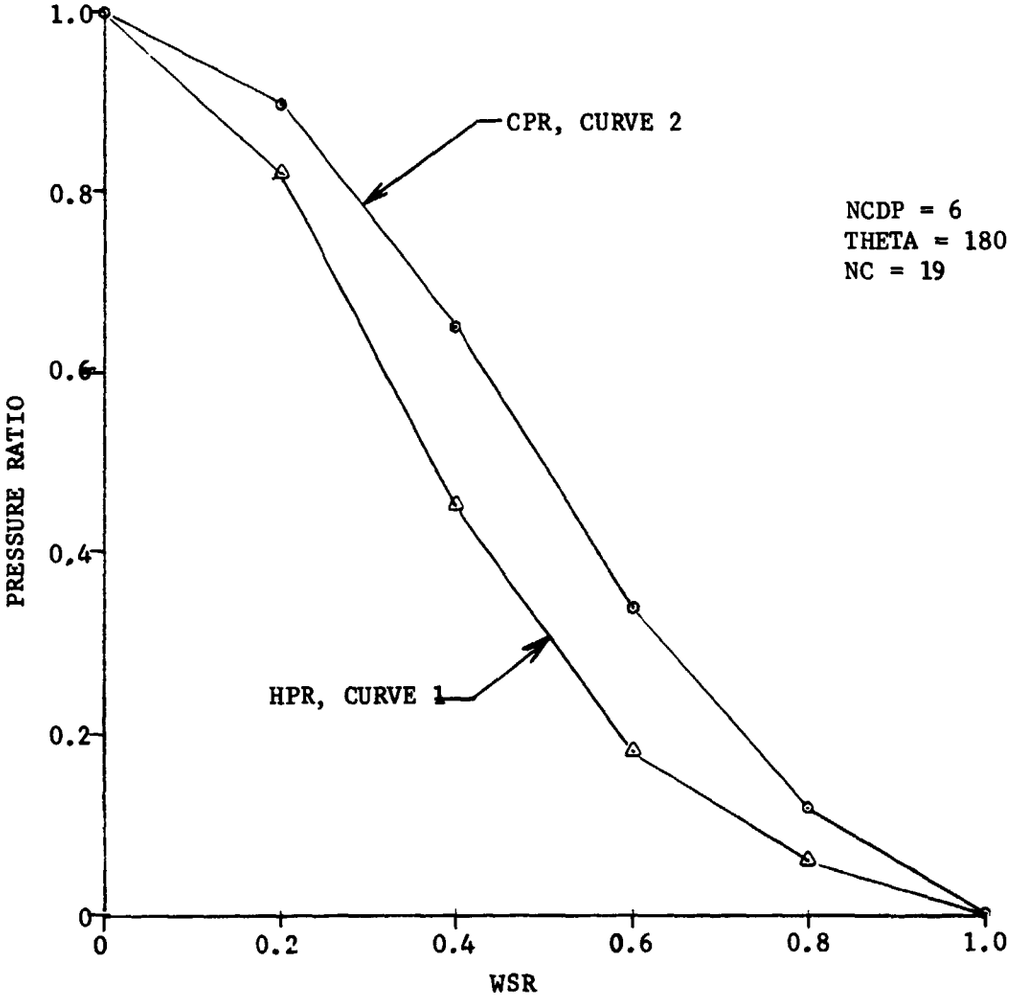


Figure 4-2 Normalized Radial Pressure Distribution for Example Problem 1

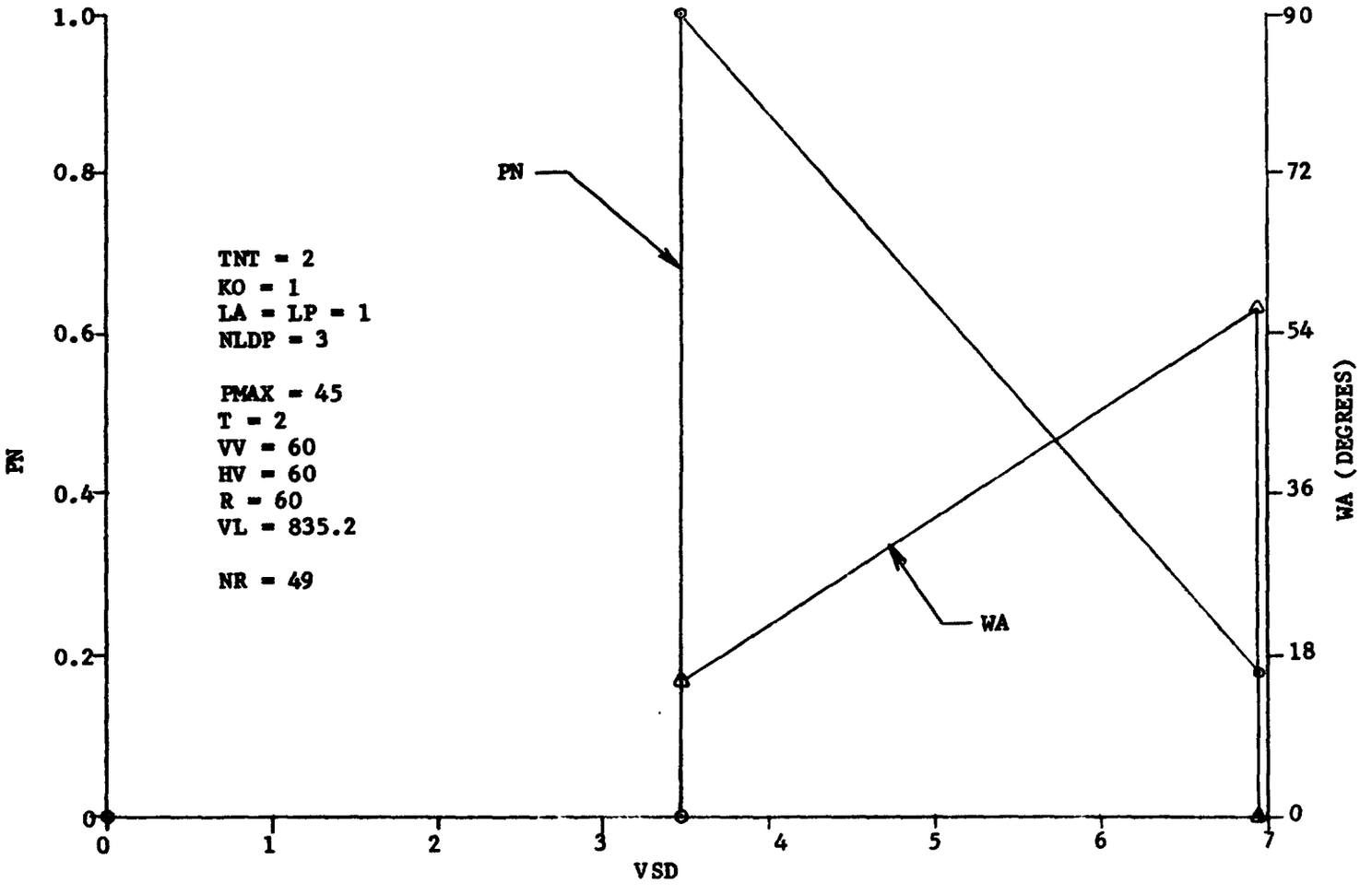


Figure 4-3 Normalized Keel Pressure and Wetted Angle Distribution for Example Problem 2

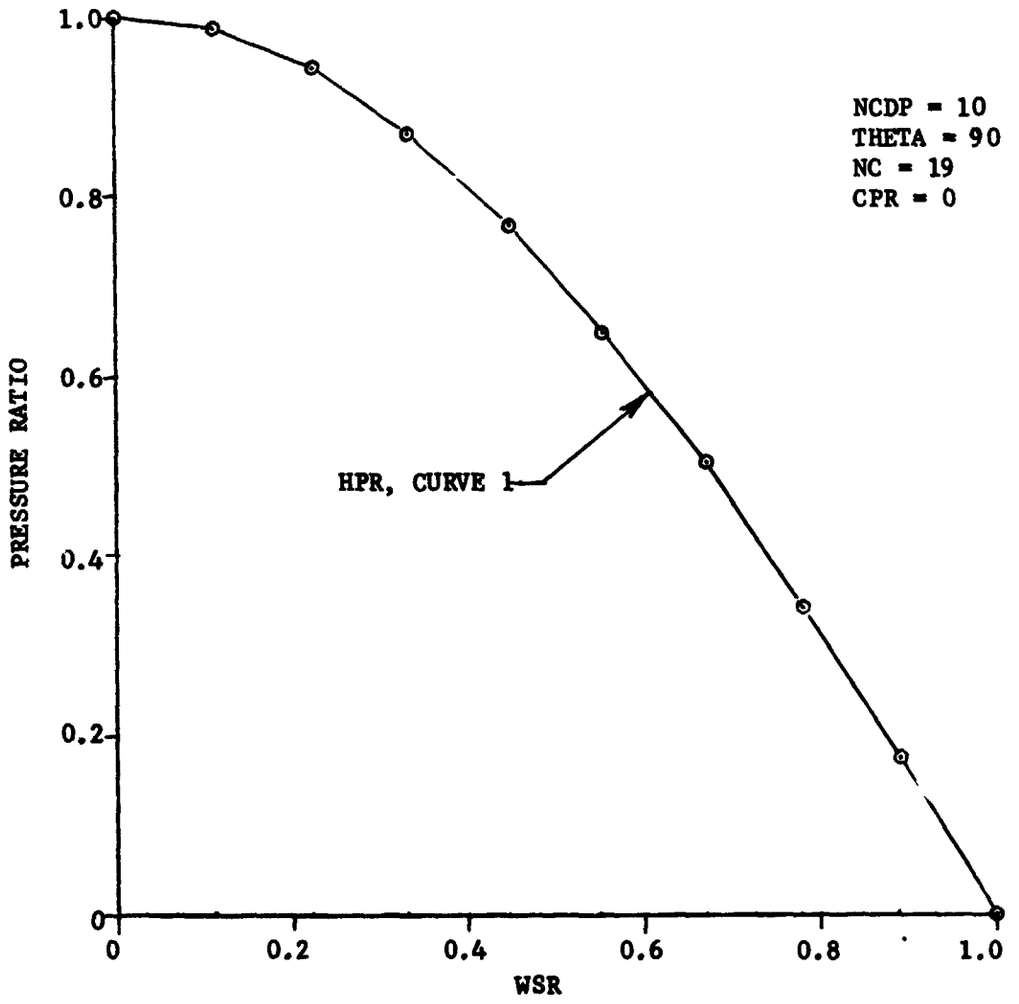


Figure 4-4 Normalized Radial Pressure Distribution for Example Problem 2

LISTING OF INPUT DATA CARDS FOR EXAMPLE PROBLEMS 1 AND 2

```
 2.0
 10     6      0      )      1
 0.0          0.0           0.0          3.30986      0.0          0.0
 3.52113     30.0           0.5          3.59155     38.0          1.0
 3.80787     58.0           0.63         4.19014     83.0          0.26
 5.0         90.0           0.04         6.0         90.0          0.0
 7.0         90.0           1.0         10.0         90.0          0.07
 0.0          1.0           1.0          0.2          0.82         0.9
 0.4          0.45          0.65         0.6          0.18         0.34
 0.8          0.06          0.12         1.0          0.0          0.0
70.0          1.0          60.0         60.0         71.0       1420.0        180.0
 72    19
  3    10      1      1      1
 0.0          0.0           0.0          3.47999     15.0          1.0
 6.96001     60.0           0.17778
 0.0          1.0           0.0          0.11111      0.98481      0.0
 0.22222      0.93969       0.0          0.33333      0.86603      0.0
 0.44444      0.76604       0.0          0.55555      0.64279      0.0
 0.66666      0.5           0.0          0.77777      0.34202      0.0
 0.88888      0.17365       0.0          1.0          0.0          0.0
45.0          2.0          60.0         60.0         60.0        835.2         90.0
 49    19
```

LISTING OF NET NORMAL AND TANGENTIAL LOADS FOR EXAMPLE PROBLEM 1

STVL= 215744.55 STVLXC= 154070145.04 S2TVL= 411489.29 CP= 748.84

XCORD	YCORD	ANL	ATTL
0.	0.	0.	0.
0.	10.00000	0.	0.
0.	20.00000	0.	0.
0.	30.00000	0.	0.
0.	40.00000	0.	0.
0.	50.00000	0.	0.
0.	60.00000	0.	0.
0.	70.00000	0.	0.
0.	80.00000	0.	0.
0.	90.00000	0.	0.
0.	100.00000	0.	0.
0.	110.00000	0.	0.
0.	120.00000	0.	0.
0.	130.00000	0.	0.
0.	140.00000	0.	0.
0.	150.00000	0.	0.
0.	160.00000	0.	0.
0.	170.00000	0.	0.
0.	180.00000	0.	0.
20.00000	0.	0.	0.
20.00000	10.00000	0.	0.
20.00000	20.00000	0.	0.
20.00000	30.00000	0.	0.
20.00000	40.00000	0.	0.
20.00000	50.00000	0.	0.
20.00000	60.00000	0.	0.
20.00000	70.00000	0.	0.
20.00000	80.00000	0.	0.
20.00000	90.00000	0.	0.

20.03000	100.00000	0.	0.
20.00000	110.00000	0.	0.
20.03000	120.00000	0.	0.
20.03000	130.00000	0.	0.
20.03000	140.00000	0.	0.
20.00000	150.00000	0.	0.
20.00000	160.00000	0.	0.
20.00000	170.00000	0.	0.
20.00000	180.00000	0.	0.
40.00000	0.	0.	0.
40.00000	10.00000	0.	0.
40.00000	20.00000	0.	0.
40.00000	30.00000	0.	0.
40.00000	40.00000	0.	0.
40.00000	50.00000	0.	0.
40.00000	60.00000	0.	0.
40.00000	70.00000	0.	0.
40.00000	80.00000	0.	0.
40.00000	90.00000	0.	0.
40.00000	100.00000	0.	0.
40.00000	110.00000	0.	0.
40.00000	120.00000	0.	0.
40.00000	130.00000	0.	0.
40.00000	140.00000	0.	0.
40.00000	150.00000	0.	0.
40.00000	160.00000	0.	0.
40.00000	170.00000	0.	0.
40.00000	180.00000	0.	0.
60.00000	0.	0.	0.
60.00000	10.00000	0.	0.
60.00000	20.00000	0.	0.
60.00000	30.00000	0.	0.
60.00000	40.00000	0.	0.

50.01000	50.00000	0.	0.
60.00000	60.00000	0.	0.
60.00000	70.00000	0.	0.
60.00000	80.00000	0.	0.
60.00000	90.00000	0.	0.
60.00000	100.00000	0.	0.
60.01000	110.00000	0.	0.
60.01000	120.00000	0.	0.
60.00000	130.00000	0.	0.
60.00000	140.00000	0.	0.
60.00000	150.00000	0.	0.
60.00000	160.00000	0.	0.
60.01000	170.00000	0.	0.
60.00000	180.00000	0.	0.
90.00000	0.		0.
90.00000	10.00000		0.
90.01000	20.00000		0.
90.00000	30.00000		0.
90.00000	40.00000		0.
90.01000	50.01000	0.	0.
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90.01000	70.00000	0.	0.
90.01000	80.00000	0.	0.
90.00000	90.00000	0.	0.
90.00000	100.00000	0.	0.
90.00000	110.00000	0.	0.
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90.00000	140.00000	0.	0.
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100.00000	50.00000	0.	0.
100.00000	60.00000	0.	0.
100.01000	70.00000	0.	0.
100.00000	80.00000	0.	0.
100.00000	90.00000	0.	0.
100.00000	100.00000	0.	0.
100.00000	110.00000	0.	0.
100.01000	120.00000	0.	0.
100.01000	130.00000	0.	0.
100.01000	140.00000	0.	0.
100.00000	150.00000	0.	0.
100.01000	160.00000	0.	0.
100.00000	170.00000	0.	0.
100.01000	180.00000	0.	0.
120.00000	0.	0.	0.
120.01000	10.00000	0.	0.
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120.00000	30.00000	0.	0.
120.00000	40.00000	0.	0.
120.00000	50.00000	0.	0.
120.00000	60.00000	0.	0.
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120.00000	80.00000	0.	0.
120.01000	90.00000	0.	0.

120.[illegible]	100.[illegible]	[illegible]	0.
120.[illegible]	110.[illegible]	0.	0.
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120.[illegible]	130.[illegible]	0.	0.
120.[illegible]	140.[illegible]	0.	0.
120.[illegible]	150.[illegible]	0.	0.
120.[illegible]	160.[illegible]	0.	0.
120.[illegible]	170.[illegible]	0.	0.
120.[illegible]	180.[illegible]	0.	0.
140.[illegible]	0.	0.	0.
140.[illegible]	10.[illegible]	[illegible]	0.
140.[illegible]	20.[illegible]	0.	0.
140.[illegible]	30.[illegible]	0.	0.
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1060.00000	90.00000	-3.12364	-39.43435
1060.00000	100.00000	-6.84770	-38.83526
1060.00000	110.00000	-13.48734	-37.05617
1060.00000	120.00000	-19.71718	-34.15115
1060.00000	130.00000	-25.34791	-30.20847
1060.00000	140.00000	-30.20847	-25.34741
1060.00000	150.00000	-34.15115	-19.71718
1060.00000	160.00000	-37.05617	-13.48734
1060.00000	170.00000	-38.83526	-6.84770
1060.00000	180.00000	[illegible]	.00000
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1080.00000	10.00000	-160.79508	-8.92276
1080.00000	20.00000	-162.26439	-17.57442
1080.00000	30.00000	-135.15087	-25.69208
1080.00000	40.00000	-102.41670	-33.12910
1080.00000	50.00000	-69.44298	-39.36255
1080.00000	60.00000	-41.16429	-44.49998
1080.00000	70.00000	-20.70735	-48.28531
1080.00000	80.00000	-8.16731	-50.60351
1080.00000	90.00000	-4.07046	-51.38416
1080.00000	100.00000	-8.92276	-50.60351
1080.00000	110.00000	-17.57442	-48.28531
1080.00000	120.00000	-25.69208	-44.49998
1080.00000	130.00000	-33.02910	-39.36255
1080.00000	140.00000	-39.36255	-33.12910
1080.00000	150.00000	-44.49998	-25.69208
1080.00000	160.00000	-48.28531	-17.57442
1080.00000	170.00000	-50.60351	-8.92276
1080.00000	180.00000	-25.69208	.00000
1100.00000	0.	-115.78458	0.
1100.00000	10.00000	-222.84168	-10.99783
1100.00000	20.00000	-200.00030	-21.66149
1100.00000	30.00000	-166.58130	-31.66698
1100.00000	40.00000	-126.23454	-40.71028
1100.00000	50.00000	-85.59251	-48.51663
1100.00000	60.00000	-50.73738	-54.84882
1100.00000	70.00000	-25.52301	-59.51445
1100.00000	80.00000	-10.05668	-62.37177

1100.[illegible]	[illegible]	-5.81708	-63.33396
1100.00000	100.00000	-10.99783	-62.37177
1100.01000	110.00000	-21.66149	-59.51445
1100.02000	120.00000	-31.66698	-54.34882
1100.00000	130.00000	-40.71028	-48.51663
1100.00000	140.00000	-48.51663	-40.71028
1100.00000	150.00000	-54.84887	-31.66698
1100.00000	160.00000	-59.51445	-21.66149
1100.01000	170.00000	-62.37177	-10.99783
1100.02000	180.00000	-31.66698	.00000
1120.00100	0.	-137.63977	
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1120.00010	20.00000	-237.73620	-25.74856
1120.00000	30.00000	-198.81174	-37.64188
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1120.00000	50.00000	-101.74204	-57.67071
1120.00000	60.00000	-60.31047	-65.19765
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1120.00000	80.00000	-11.96606	-74.14003
1120.00000	90.00000	-5.96370	-75.28376
1120.00000	100.00000	-13.07289	-74.14007
1120.00000	110.00000	-25.74856	-70.74360
1120.00000	120.00000	-37.64188	-65.19765
1120.00000	130.00000	-48.39147	-57.67071
1120.00000	140.00000	-57.67071	-48.39147
1120.00000	150.00000	-65.19765	-37.64188
1120.00000	160.00000	-70.74360	-25.74856
1120.00000	170.00000	-74.14003	-13.07289
1120.00000	180.00000	-37.64188	.00000
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1140.00000	20.00000	-275.47211	-29.83564
1140.00000	30.00000	-229.44217	-43.61678
1140.00000	40.00000	-173.87021	-56.07266
1140.00000	50.00000	-117.89157	-66.82479
1140.00000	60.00000	-69.88356	-75.54648
1140.00000	70.00000	-35.15434	-81.97274
1140.00000	80.00000	-13.86543	-85.90829
1140.00000	90.00000	-6.91032	-87.23357
1140.00000	100.00000	-15.14795	-85.90829
1140.00000	110.00000	-29.83564	-81.97274
1140.00000	120.00000	-43.61678	-75.54648
1140.00000	130.00000	-56.07266	-66.82479
1140.00000	140.00000	-66.82479	-56.07266
1140.00000	150.00000	-75.54648	-43.61678
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1140.00000	170.00000	-85.90829	-15.14795
1140.00000	180.00000	-43.61678	.00000
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1160.00000	20.00000	-313.20201	-33.92271
1150.00000	30.00000	-260.87260	-49.59168
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1150.00000	60.00000	-79.45665	-85.89532
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1150.00000	130.00000	-63.75384	-75.97887

1150.00000	140.00000	-75.97887	-63.75384
1150.00000	150.00000	-85.83532	-49.59168
1150.00000	160.00000	-93.20188	-33.92271
1150.00000	170.00000	-97.67655	-17.22301
1150.00000	180.00000	-49.59168	.00000
1160.00000	0.	-203.16917	0.
1160.00000	10.00000	-391.02408	-19.29807
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1160.00000	30.00000	-292.30304	-55.56659
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1160.00000	50.00000	-150.19063	-85.13295
1160.00000	60.00000	-89.02974	-96.24415
1160.00000	70.00000	-44.79566	-104.43102
1160.00000	80.00000	-17.66418	-109.44481
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1160.00000	170.00000	-109.44481	-19.29807
1160.00000	180.00000	-55.56659	.00000
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1200.00000	30.00000	-323.73347	-61.54149
1200.00000	40.00000	-245.32373	-79.11621
1200.00000	50.00000	-166.34016	-94.28703
1200.00000	60.00000	-98.60283	-106.59298
1200.00000	70.00000	-49.60132	-115.66016
1200.00000	80.00000	-19.56355	-121.21307
1200.00000	90.00000	-9.75017	-123.08298
1200.00000	100.00000	-21.37313	-121.21307
1200.00000	110.00000	-42.09686	-115.66016
1200.00000	120.00000	-61.54149	-106.59298
1200.00000	130.00000	-79.11621	-94.28703
1200.00000	140.00000	-94.28703	-79.11621
1200.00000	150.00000	-106.59298	-61.54149
1200.00000	160.00000	-115.66016	-42.09686
1200.00000	170.00000	-121.21307	-21.37313
1200.00000	180.00000	-61.54149	.00000
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1220.00000	20.00000	-426.41573	-46.18393
1220.00000	30.00000	-355.16391	-67.51639
1220.00000	40.00000	-269.14156	-86.79740
1220.00000	50.00000	-182.44969	-103.44111
1220.00000	60.00000	-108.17592	-116.94182
1220.00000	70.00000	-54.41698	-126.88931
1220.00000	80.00000	-21.46293	-132.98133
1220.00000	90.00000	-10.69679	-135.03278
1220.00000	100.00000	-23.44820	-132.98133
1220.00000	110.00000	-46.18393	-126.88931
1220.00000	120.00000	-67.51639	-116.94182
1220.00000	130.00000	-86.79740	-103.44111
1220.00000	140.00000	-103.44111	-86.79740
1220.00000	150.00000	-116.94182	-67.51639
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1220.00000	180.00000	-67.51639	.00000

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1240.00000	40.00000	-292.95940	-94.47858
1240.00000	50.00000	-198.63923	-112.59519
1240.00000	60.00000	-117.74501	-127.29065
1240.00000	70.00000	-60.23265	-138.11845
1240.00000	80.00000	-23.76230	-144.74959
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1240.00000	110.00000	-50.27100	-138.11845
1240.00000	120.00000	-73.49129	-127.29065
1240.00000	130.00000	-94.47858	-112.59519
1240.00000	140.00000	-112.59519	-94.47858
1240.00000	150.00000	-127.29065	-73.49129
1240.00000	160.00000	-138.11845	-50.27100
1240.00000	170.00000	-144.74959	-25.52326
1240.00000	180.00000	-73.49129	.00000
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1250.00000	10.00000	-550.20647	-27.59832
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1250.00000	40.00000	-316.77724	-102.15977
1250.00000	50.00000	-214.73876	-121.74927
1250.00000	60.00000	-127.32810	-137.63948
1250.00000	70.00000	-64.04831	-149.34759
1250.00000	80.00000	-25.26167	-156.51785
1250.00000	90.00000	-12.59003	-158.93239
1250.00000	100.00000	-27.59832	-156.51785
1250.00000	110.00000	-54.35808	-149.34759
1250.00000	120.00000	-79.46619	-137.63948
1250.00000	130.00000	-102.15977	-121.74927
1250.00000	140.00000	-121.74927	-102.15977
1250.00000	150.00000	-137.63948	-79.46619
1250.00000	160.00000	-149.34759	-54.35808
1250.00000	170.00000	-156.51785	-27.59832
1250.00000	180.00000	-79.46619	.00000
1280.00000	0.	-312.39901	0.
1280.00000	10.00000	-601.25207	-29.67338
1280.00000	20.00000	-539.62344	-58.44515
1280.00000	30.00000	-449.45521	-85.44110
1280.00000	40.00000	-340.59508	-109.84096
1280.00000	50.00000	-230.07829	-130.90335
1280.00000	60.00000	-136.89519	-147.98832
1280.00000	70.00000	-68.86397	-160.57673
1280.00000	80.00000	-27.16105	-168.28611
1280.00000	90.00000	-13.53665	-170.98219
1280.00000	100.00000	-29.67338	-168.28611
1280.00000	110.00000	-58.44515	-160.57673
1280.00000	120.00000	-85.44110	-147.98832
1280.00000	130.00000	-109.84096	-130.90335
1280.00000	140.00000	-130.90335	-109.84096
1280.00000	150.00000	-147.98832	-85.44110
1280.00000	160.00000	-160.57673	-58.44515
1280.00000	170.00000	-168.28611	-29.67338
1280.00000	180.00000	-85.44110	.00000
1300.00000	0.	-334.24606	0.
1300.00000	10.00000	-643.29767	-31.74844
1300.00000	20.00000	-577.35935	-62.53229
1300.00000	30.00000	-480.88564	-91.41600
1300.00000	40.00000	-364.41292	-117.52214

1300.00000	50.00000	-247.03782	-140.05743
1300.00000	60.00000	-146.66828	-158.33715
1300.00000	70.00000	-73.67963	-171.80588
1300.00000	80.00000	-29.06042	-180.05437
1300.00000	90.00000	-14.48727	-182.33199
1300.00000	100.00000	-31.74844	-180.05437
1300.00000	110.00000	-62.53222	-171.80588
1300.00000	120.00000	-91.41600	-158.33715
1300.00000	130.00000	-117.52214	-140.05743
1300.00000	140.00000	-140.05743	-117.52214
1300.00000	150.00000	-158.33715	-91.41600
1300.00000	160.00000	-171.80588	-62.53222
1300.00000	170.00000	-180.05437	-31.74844
1300.00000	180.00000	-91.41600	.00000
1320.00000	0.	-356.09721	0.
1320.00000	10.00000	-685.34327	-33.82350
1320.00000	20.00000	-615.09525	-66.61930
1320.00000	30.00000	-512.31668	-97.39090
1320.00000	40.00000	-388.23075	-125.20333
1320.00000	50.00000	-263.23735	-149.21151
1320.00000	60.00000	-156.04138	-168.68599
1320.00000	70.00000	-78.49530	-183.03502
1320.00000	80.00000	-30.95980	-191.82262
1320.00000	90.00000	-15.42989	-194.78180
1320.00000	100.00000	-33.82350	-191.82262
1320.00000	110.00000	-66.61930	-183.03502
1320.00000	120.00000	-97.39090	-168.68599
1320.00000	130.00000	-125.20333	-149.21151
1320.00000	140.00000	-149.21151	-125.20333
1320.00000	150.00000	-168.68599	-97.39090
1320.00000	160.00000	-183.03502	-66.61930
1320.00000	170.00000	-191.82262	-33.82350
1320.00000	180.00000	-97.39090	.00000
1340.00000	0.	-377.93836	0.
1340.00000	10.00000	-727.33887	-35.89857
1340.00000	20.00000	-652.83116	-70.70637
1340.00000	30.00000	-543.74651	-103.36580
1340.00000	40.00000	-412.04859	-132.88451
1340.00000	50.00000	-279.38688	-158.36559
1340.00000	60.00000	-165.61447	-179.03482
1340.00000	70.00000	-83.31096	-194.26416
1340.00000	80.00000	-32.85917	-203.59088
1340.00000	90.00000	-16.37651	-206.73160
1340.00000	100.00000	-35.89857	-203.59088
1340.00000	110.00000	-70.70637	-194.26416
1340.00000	120.00000	-103.36580	-179.03482
1340.00000	130.00000	-132.88451	-158.36559
1340.00000	140.00000	-158.36559	-132.88451
1340.00000	150.00000	-179.03482	-103.36580
1340.00000	160.00000	-194.26416	-70.70637
1340.00000	170.00000	-203.59088	-35.89857
1340.00000	180.00000	-103.36580	.00000
1360.00000	0.	-399.78451	0.
1360.00000	10.00000	-769.47447	-37.97363
1360.00000	20.00000	-690.56706	-74.79345
1360.00000	30.00000	-575.17695	-109.34870
1360.00000	40.00000	-435.86643	-140.56570
1360.00000	50.00000	-295.53641	-167.51968
1360.00000	60.00000	-175.18756	-189.38365
1360.00000	70.00000	-88.12662	-205.49330
1360.00000	80.00000	-34.75855	-215.35914
1360.00000	90.00000	-17.32313	-218.68141

1360.00000	100.00000	-37.97363	-215.35914
1360.00000	110.00000	-74.79345	-205.49330
1360.00000	120.00000	-109.34070	-189.78365
1360.00000	130.00000	-140.56570	-167.51968
1360.00000	140.00000	-167.51968	-140.56570
1360.00000	150.00000	-189.78365	-109.34070
1360.00000	160.00000	-205.49330	-74.79345
1360.00000	170.00000	-215.35914	-37.97363
1360.00000	180.00000	-109.34070	.00000
1390.00000	0.	-421.63065	0.
1390.00000	10.00000	-811.49007	-40.04869
1390.00000	20.00000	-728.30297	-78.88052
1390.00000	30.00000	-606.60778	-115.31560
1390.00000	40.00000	-459.63427	-148.24688
1390.00000	50.00000	-311.63594	-176.67376
1390.00000	60.00000	-194.76065	-199.73249
1390.00000	70.00000	-92.94228	-216.72245
1390.00000	80.00000	-36.65792	-227.12740
1390.00000	90.00000	-18.26974	-230.63121
1390.00000	100.00000	-40.04869	-227.12740
1390.00000	110.00000	-78.88052	-216.72245
1390.00000	120.00000	-115.31560	-199.73249
1390.00000	130.00000	-148.24688	-176.67376
1390.00000	140.00000	-176.67376	-148.24688
1390.00000	150.00000	-199.73249	-115.31560
1390.00000	160.00000	-216.72245	-78.88052
1390.00000	170.00000	-227.12740	-40.04869
1390.00000	180.00000	-115.31560	.00000
1410.00000	0.	-443.47680	0.
1410.00000	10.00000	-853.52567	-42.12375
1410.00000	20.00000	-766.03887	-82.96759
1410.00000	30.00000	-638.03761	-121.29051
1410.00000	40.00000	-483.50210	-155.92807
1410.00000	50.00000	-327.83547	-185.82784
1410.00000	60.00000	-194.33374	-210.08132
1410.00000	70.00000	-97.75795	-227.95159
1410.00000	80.00000	-38.55729	-238.89566
1410.00000	90.00000	-19.21636	-242.58101
1410.00000	100.00000	-42.12375	-238.89566
1410.00000	110.00000	-82.96759	-227.95159
1410.00000	120.00000	-121.29051	-210.08132
1410.00000	130.00000	-155.92807	-185.82784
1410.00000	140.00000	-185.82784	-155.92807
1410.00000	150.00000	-210.08132	-121.29051
1410.00000	160.00000	-227.95159	-82.96759
1410.00000	170.00000	-238.89566	-42.12375
1410.00000	180.00000	-121.29051	.00000
1420.00000	0.	-227.19694	0.
1420.00000	10.00000	-437.27424	-21.58064
1420.00000	20.00000	-392.45341	-42.50556
1420.00000	30.00000	-326.87652	-62.13898
1420.00000	40.00000	-247.70551	-79.88433
1420.00000	50.00000	-167.95512	-95.20244
1420.00000	60.00000	-99.56014	-107.62787
1420.00000	70.00000	-50.08789	-116.78308
1420.00000	80.00000	-19.75749	-122.38990
1420.00000	90.00000	-9.84484	-124.27796
1420.00000	100.00000	-21.58064	-122.38990
1420.00000	110.00000	-42.50556	-116.78308
1420.00000	120.00000	-62.13898	-107.62787
1420.00000	130.00000	-79.88433	-95.20244
1420.00000	140.00000	-95.20244	-79.88433
1420.00000	150.00000	-107.62787	-62.13898
1420.00000	160.00000	-116.78308	-42.50556
1420.00000	170.00000	-122.38990	-21.58064
1420.00000	180.00000	-62.13898	.00000

LISTING OF NET NORMAL AND TANGENTIAL LOADS FOR EXAMPLE PROBLEM 2

STVL= 276422.95 STVLXC= 139477319.76 SPTVL= 452845.89 CP= 616.00

XCCG)	YCGR)	ANL	ATTL
0.	0.	0.	0.
0.	5.00000	0.	0.
0.	10.00000	0.	0.
0.	15.00000	0.	0.
0.	20.00000	0.	0.
0.	25.00000	0.	0.
0.	30.00000	0.	0.
0.	35.00000	0.	0.
0.	40.00000	0.	0.
0.	45.00000	0.	0.
0.	50.00000	0.	0.
0.	55.00000	0.	0.
0.	60.00000	0.	0.
0.	65.00000	0.	0.
0.	70.00000	0.	0.
0.	75.00000	0.	0.
0.	80.00000	0.	0.
0.	85.00000	0.	0.
0.	90.00000	0.	0.
17.40000	0.	0.	0.
17.40000	5.00000	0.	0.
17.40000	10.00000	0.	0.
17.40000	15.00000	0.	0.
17.40000	20.00000	0.	0.
17.40000	25.00000	0.	0.
17.40000	30.00000	0.	0.
17.40000	35.00000	0.	0.

17.40000	40.00000	0.	0.
17.40000	45.00000	0.	0.
17.40000	50.00000	0.	0.
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469.80000	60.00000	261.13690	-452.30238
469.80000	65.00000	220.72245	-473.34081
469.80000	70.00000	178.62816	-490.77684
469.80000	75.00000	135.17441	-504.47775
469.80000	80.00000	90.69189	-514.33929
469.80000	85.00000	45.51016	-520.28639
469.80000	90.00000	-.00000	-261.13690
497.20000	0.	-1442.66568	0.
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497.20000	10.00000	-2090.13026	-95.36775
497.20000	15.00000	-1136.75493	-142.14368
497.20000	20.00000	-195.52799	-187.93780
497.20000	25.00000	459.75569	-232.10237
497.20000	30.00000	475.62201	-274.69050
497.20000	35.00000	449.67911	-315.10475
497.20000	40.00000	420.71237	-353.01959
497.20000	45.00000	388.34375	-388.34375
497.20000	50.00000	353.01959	-420.71237
497.20000	55.00000	315.10475	-449.67911
497.20000	60.00000	274.69050	-475.62201
497.20000	65.00000	232.10237	-497.74514
497.20000	70.00000	187.93780	-516.08012
497.20000	75.00000	142.14368	-530.48742
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497.20000	85.00000	47.66602	-547.11112
497.20000	90.00000	-.00000	-274.69050
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504.60000	10.00000	-2080.13008	-98.85715
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522.00000	35.00000	480.70346	-336.59219
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522.00000	70.00000	200.70787	-551.44035

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522.00000	90.00000	-.00000	-293.41529
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556.80000	40.00000	467.60483	-392.36704
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574.20000	15.00000	-1465.28565	-159.43404
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574.20000	35.00000	495.43901	-353.32642
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678.60000	15.00000	-1133.77331	-149.39020
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713.40000	15.00000	-976.62036	-137.23457
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713.40000	25.00000	-655.25473	-224.08644
713.40000	30.00000	-449.99500	-265.11684
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817.80000	60.00000	154.07259	-279.21032
817.80000	65.00000	136.25380	-292.19722
817.80000	70.00000	110.26865	-302.96062
817.80000	75.00000	83.44428	-311.41831
817.80000	80.00000	55.98486	-317.50592
817.80000	85.00000	28.03936	-321.17711
817.80000	90.00000	-.00000	-161.20198
835.20000	0.	-123.76252	0.
835.20000	5.00000	-244.21438	-13.08091
835.20000	10.00000	-235.06451	-26.06227
835.20000	15.00000	-220.93219	-38.94527
835.20000	20.00000	-201.52670	-51.33264
835.20000	25.00000	-176.62077	-63.42934
835.20000	30.00000	-147.11755	-75.04330
835.20000	35.00000	-114.10422	-86.08614
835.20000	40.00000	-77.95615	-96.47381
835.20000	45.00000	-39.03324	-106.12726
835.20000	50.00000	1.72957	-114.97301
835.20000	55.00000	41.23055	-122.94375
835.20000	60.00000	67.96017	-129.97881
835.20000	65.00000	63.42934	-136.02466
835.20000	70.00000	51.33264	-141.03527
835.20000	75.00000	38.84527	-144.97253
835.20000	80.00000	26.06227	-147.80645
835.20000	85.00000	13.08091	-149.51548
835.20000	90.00000	-.00000	-75.04330

LISTING OF WATER IMPACT LOADS PROGRAM

```
      PROGRAM DD(INPUT,OUTPUT,TAPE2=INPUT,TAPE3=OUTPUT,PUNCH)
C     MOD TO OBTAIN PUNCHED CARDS ONLY.
      DIMENSION VSD(20),WA(20),PN(20),WSR(20),HPR(20),CPR(20),XCORD(100)
      DIMENSION YCORD(37),SEGLX(37),NSEGX(37),DL(37),SEGLY(20),NSEGY(20)
      DIMENSION DC(20),DVSD(20),DWA(20),DPN(20),XPN(100),XWA(100)
      DIMENSION CWSR(100,37),PCR(100,37),PL(100,37),DWSR(20),DHPR(20)
      DIMENSION DCPR(20),ANL(100,37),AVL(100,37),TVL(100),TVLXC(100)
      DIMENSION RL(100),AWA(100),VIL(100,37),ANIL(100,37),ATIL(100,37)
      DIMENSION TVIL(100),REACT(100),STRAP(100)
    1 FORMAT(16I5)
    2 FORMAT(6F10.5)
    3 FORMAT(8F10.5)
    4 FORMAT(8E10.6)
C   5 FORMAT(3F20.5)
C   6 FORMAT(5F20.5)
C   7 FORMAT(10X,4HTNT=,F10.5)
C   8 FORMAT(10X,3HVSD,10X,2HWA,10X,2HPN,//)
C   9 FORMAT(9X,F10.5,8X,F10.5,8X,F10.5)
C  10 FORMAT(1H1)
C  11 FORMAT(10X,3HWSR,10X,3HHPR,10X,3HCPR,//)
C  12 FORMAT(9X,F10.5,8X,F10.5,8X,F10.5)
C  13 FORMAT(2X,5HPMAX=,F10.5,2X,2HT=,F10.5,2X,3HVV=,F10.5,2X,3HHV=,F10.
C    15,2X,2HR=,F10.5,2X,3HVL=,F10.5)
C  14 FORMAT(10X,4HDVSD,20X,3HDWA,20X,3HDPN,//)
C  15 FORMAT(2X,F20.5,5X,F20.5,3X,F20.5)
C  16 FORMAT(10X,5HXCORD,20X,3HXPN,20X,3HXWA,//)
C  17 FORMAT(10X,4HDWSR,20X,4HDHPR,20X,4HDCPR,//)
C  18 FORMAT(8X,5HXCORD,15X,5HYCORD,15X,4HCWSR,17X,3HPCR,17X,2HPL,//)
C  19 FORMAT(8X,5HXCORD,15X,5HYCORD,16X,3HANL,17X,3HAVL,17X,3HTVL,//)
C  20 FORMAT(8X,5HXCORD,16X,3HTVL,16X,5HTVLXC,//)
C  21 FORMAT(5X,5HSTVL=,F10.2,5X,7HSTVLXC=,F15.2,5X,6HS2TVL=,F10.2,5X,3H
C    1CP=,F10.2)
C  22 FORMAT(10X,5HXCORD,20X,3HXWA,20X,2HRL,//)
C  23 FORMAT(8X,5HXCORD,15X,5HYCORD,16X,3HVIL,16X,4HANIL,16X,4HATIL,//)
C  24 FORMAT(10X,3HUB=,F20.10)
   25 FORMAT(E10.3,3I5)
C  26 FORMAT(8X,5HXCORD,15X,5HYCORD,16X,3HANL,16X,4HATIL,//)
C  27 FORMAT(4F20.5)
   28 FORMAT(F10.2,10X,F10.2)
C                    LIST OF PROGRAM NOMENCLATURE
C
C A         DEGREE TO RADIAN CONVERSION
C ANGLE     180 LESS INCLUSIVE ANGLE/2 OVER WHICH REACTING STRAP BEARS
C ANIL      NORMAL INERTIA LOAD COMPONENT AT A NODE
C ANL       NORMAL LOAD AT MESH POINT
C ATIL      TANGENTIAL INERTIA LOAD COMPONENT AT A NODE
C AVL       VERTICAL COMPONENT OF NORMAL LOAD
C AWA       WETTED ANGLE AT MESH POINT
C CP        CENTER OF PRESSURE
C CPR       RADIAL PRESSURE DISTRIBUTION CURVE 2 (WETTED ANGLE EQUAL 90)
C CWSR      WETTED SURFACE RATIO OF YCORD IN MESH
C D         VEHICLE DIAMETER
C DC        INCREMENTAL LENGTH IN SEGMENT Y
C DCPR      INCREMENTAL PRESSURE RATIO FOR CURVE 2
C DHPR      INCREMENTAL PRESSURE RATIO FOR CURVE 1
C DL        INCREMENTAL LENGTH IN SEGMENT X
C DPN       INCREMENTAL PRESSURE
C DVSD      INCREMENTAL VEHICLE STATION
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C DWA       INCREMENTAL WETTED ANGLE
C DWSR      INCREMENTAL WETTED SURFACE RATIO
C DX        INCREMENTAL DISTANCE ALONG X COORDINATE
C DY        INCREMENTAL DISTANCE ALONG Y COORDINATE
C HC        PORTION OF VEHICLE CIRCUMFERENCE
C HPR       RADIAL PRESSURE DISTRIBUTION CURVE 1 (WETTED ANGLE LESS 90)
C HV        HORIZONTAL VELOCITY
C KO        CODE FOR DESIRED OUTPUT (0,1, OR 2)
C LA        CODE FOR SHAPE OF PRESSURE CURVE (0 OR 1)
C LP        CODE FOR SHAPE OF WETTED ANGLE CURVE (0 OR 1)
C NC        NUMBER OF COLUMNS ALONG Y COORDINATE DIRECTION
C NCDP      NUMBER OF CIRCUMFERENTIAL DATA POINTS FOR PRESSURE
C NLDP      NUMBER OF LONGITUDINAL DATA POINTS FOR KEEL PRESSURE
C NNX       NUMBER OF SEGMENTS IN X DIRECTION WITH CONSTANT SPACING
C NNY       NUMBER OF SEGMENTS IN Y DIRECTION WITH CONSTANT SPACING
C NR        NUMBER OF ROWS ALONG X COORDINATE DIRECTION
C NSEGX     NUMBER OF MESH SPACES WITHIN SEGMENT X
C NSEGY     NUMBER OF MESH SPACES WITHIN SEGMENT Y
C PCR       PRESSURE RATIO OF YCORD IN MESH AT A LONGITUDINAL STATION
C PI        PI
C PL        PRESSURE AT YCORD IN MESH
C PMAX      MAXIMUM PRESSURE
C PN        NORMALIZED PRESSURE AT A VEHICLE STATION
C R         VEHICLE RADIUS
C REACT     UNIFORM STRAP BEARING LOAD AT A LONGITUDINAL STATION
C RL        AVERAGE PEAK RUNNING LOAD AT A LONGITUDINAL STATION
C SEGLX     LENGTH OF SEGMENT IN X DIRECTION
C SEGLY     ANGLE OF SEGMENT IN Y DIRECTION
C STRAP     STRAP TENSION LOAD AT A LONGITUDINAL STATION
C STVIL     TOTAL VERTICAL INERTIA LOAD ON VEHICLE
C STVL      HALF OF TOTAL VERTICAL PRESSURE LOAD ON VEHICLE
C STVLXC    TOTAL FIRST MOMENT OF VERTICAL PRESSURE LOAD ON VEHICLE
C S2TVL     TOTAL VERTICAL LOAD ON VEHICLE DUE TO PRESSURE
C T         TIME POINT NUMBER
C THETA     INCLUSIVE ANGLE USED IN VEHICLE MODEL (90 OR 180)
C TL        TOTAL X LENGTH
C TNT       TOTAL NUMBER OF TIME POINTS
C TVIL      TOTAL VERTICAL INERTIA LOAD AT A VEHICLE STATION
C TVL       TOTAL VERTICAL PRESSURE LOAD AT A VEHICLE STATION
C TVLXC     FIRST MOMENT OF TOTAL VERTICAL PRESSURE LOAD AT A STATION
C UB        UNBALANCE BETWEEN PRESSURE AND INERTIA LOADING
C VIL       VERTICAL INERTIA LOAD AT A MESH POINT
C VL        VEHICLE LENGTH
C VSD       NON-DIMENSIONAL VEHICLE STATION IN DIAMETERS
C VV        VERTICAL VELOCITY
C WA        WETTED ANGLE AT A VEHICLE STATION
C WSR       WETTED SURFACE RATIO
C XCORD     X-COORDINATE OF MESH POINT
C XPN       MAX PRESSURE AT A ROW IN MESH
C XWA       AVERAGE WETTED ANGLE AT A ROW IN MESH
C YCORD     Y-COORDINATE OF MESH POINT
      INTEGER Z,Y,X
      Z=1
      Y=2
      X=3
      READ(2,2)TNT
C     WRITE(3,7)TNT
   29 READ(2,1)NLDP,NCDP,LA,LP,KO
C   READING OF DATA POINTS WHICH REPRESENT WETTED ANGLE AND NORMALIZED
C   PRESSURE CURVES
      READ(2,2)(VSD(I),WA(I),PN(I),I=1,NLDP)
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```
C      WRITE(3,8)
C      WRITE(3,9)(VSD(I),WA(I),PN(I),I=1,NLOP)
C    READING OF DATA POINTS WHICH REPRESENT PRESSURE RATIO CURVES
       READ(2,2)(WSR(I),HPR(I),CPR(I),I=1,NCOP)
C      WRITE(3,11)
C      WRITE(3,12)(WSR(I),HPR(I),CPR(I),I=1,NCOP)
       READ(2,3)PMAX,T,VV,HV,R,VL,THETA,ANGLE
C      WRITE(3,13)PMAX,T,VV,HV,R,VL
       D=2.*R
       A=0.01745329252
C    DIMENSIONALIZING OF LONGITUDINAL AND PRESSURE RATIO CURVES
       DO 30 I=1,NLOP
       VSD(I)=VSD(I)*D
    30 PN(I)=PN(I)*PMAX
C      WRITE(3,8)
C      WRITE(3,5)(VSD(I),WA(I),PN(I),I=1,NLOP)
       READ(2,1)NR,NC
       IF(NR)40,50,60
C    CALCULATION OF X COORDINATES IF MESH SPACING IS CONSTANT
    60 DX=VL/(NR-1)
       DO 70 I=1,NR
       IF(I.EQ.1) GO TO 65
       XCORD(I)=XCORD(I-1)+DX
       GO TO 70
    65 XCORD(I)=0.
    70 CONTINUE
       GO TO 61
C    READING OF X COORDINATES IF SPACING IS VARIABLE
    40 NR=-NR
       READ(2,4)(XCORD(I),I=1,NR)
       GO TO 61
C    CALCULATION OF X COORDINATES IF SPACING IS CONSTANT WITHIN EACH
C    SEGMENT BUT VARIES FROM SEGMENT TO SEGMENT
    50 READ(2,1)NNX
       READ(2,4)(SEGLX(I),I=1,NNX)
       READ(2,1)(NSEGX(I),I=1,NNX)
       NR=1
       DO 90 I=1,NNX
       DL(I)=SEGLX(I)/NSEGX(I)
    90 NR=NR+NSEGX(I)
       J=1
       TL=SEGLX(J)
       DO 100 I=1,NR
       IF(I.EQ.1) GO TO 85
    95 IF(XCORD(I-1).LT.TL) GO TO 105
       J=J+1
       TL=TL+SEGLX(J)
       GO TO 95
   105 XCORD(I)=XCORD(I-1)+DL(J)
       GO TO 100
    85 XCORD(I)=0.
   100 CONTINUE
    61 IF(NC)63,64,62
C    CALCULATION OF Y COORDINATES IF MESH SPACING IS CONSTANT
    62 DY=THETA/(NC-1)
       DO 80 I=1,NC
       IF(I.EQ.1) GO TO 75
       YCORD(I)=YCORD(I-1)+DY
       GO TO 80
    75 YCORD(I)=0.
    80 CONTINUE
```

```
      GO TO 120
C   READING OF Y COORDINATES IF SPACING IS VARIABLE
   63 NC=-NC
      READ(2,4)(YCORD(I),I=1,NC)
      GO TO 120
C   CALCULATION OF Y COORDINATES IF SPACING IS CONSTANT WITHIN EACH
C   SEGMENT BUT VARIES FROM SEGMENT TO SEGMENT
   64 READ(2,1)NNY
      READ(2,4)(SEGLY(I),I=1,NNY)
      READ(2,1)(NSEGY(I),I=1,NNY)
      NC=1
      DO 110 I=1,NNY
      DC(I)=SEGLY(I)/NSEGY(I)
  110 NC=NC+NSEGY(I)
      J=1
      TC=SEGLY(J)
      DO 120 I=1,NC
      IF(I.EQ.1) GO TO 115
  125 IF(YCORD(I-1).LT.TC) GO TO 130
      J=J+1
      TC=TC+SEGLY(J)
      GO TO 125
  130 YCORD(I)=YCORD(I-1)+DC(J)
      GO TO 120
  115 YCORD(I)=0.
  120 CONTINUE
C     WRITE(3,1)NR,NC
      N=NLOP-1
C   CALCULATION OF INCREMENTAL VSD , PN , WA
      DO 140 I=1,N
      DVSD(I)=VSD(I+1)-VSD(I)
      IF(LP-1)141,142,142
  141 DPN(I)=PN(I+1)-PN(I)
      GO TO 147
  142 IF(PN(I).EQ.0.0.OR.PN(I+1).EQ.0.0) GO TO 143
      GO TO 141
  143 DPN(I)=0.0
  147 IF(LA-1)144,146,146
  144 DWA(I)=WA(I+1)-WA(I)
      GO TO 140
  146 IF(WA(I).EQ.0.0.OR.WA(I+1).EQ.0.0) GO TO 148
      GO TO 144
  148 DWA(I)=0.0
  140 CONTINUE
C     WRITE(3,14)
C     WRITE(3,15)(DVSD(I),DWA(I),DPN(I),I=1,N)
C   CALCULATION OF MAX PRESSURE AND WETTED ANGLE AT X STATION IN MESH
      J=1
      L=1
      DO 150 I=1,NR
      IF(I.EQ.1) GO TO 135
      IF(LP-1)145,186,186
  145 IF(XCORD(I).LE.VSD(J+1)) GO TO 155
      J=J+1
      GO TO 145
  155 XPN(I)=PN(J)+(XCORD(I)-VSD(J))*DPN(J)/DVSD(J)
      GO TO 187
  186 IF(I.LT.NR.AND.PN(J+1).GT.0.0) GO TO 305
      XPN(I)=PN(J+1)
      GO TO 187
  305 IF(VSD(J+1)-XCORD(I))196,196,184
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  196 J=J+1
      GO TO 305
  184 IF(PN(J))155,181,155
  181 XPN(I)=0.0
      GO TO 187
  135 XPN(I)=PN(I)
      AWA(I)=WA(I)
      GO TO 150
  187 IF(LA-1)188,189,189
  188 IF(XCORD(I).LE.VSD(L+1)) GO TO 193
      L=L+1
      GO TO 188
  193 AWA(I)=WA(L)+(XCORD(I)-VSD(L))*DWA(L)/DVSD(L)
      GO TO 150
  189 IF(I.LT.NR.AND.WA(L+1).GT.0.0) GO TO 310
      AWA(I)=WA(L+1)
      GO TO 150
  310 IF(VSD(L+1)-XCORD(I))197,197,191
  197 L=L+1
      GO TO 310
  191 IF(WA(L))193,192,193
  192 AWA(I)=0.0
  150 CONTINUE
C     WRITE(3,16)
C     WRITE(3,15)(XCORD(I),XPN(I),AWA(I),I=1,NR)
C   CALCULATION OF RL AT EACH X STATION
      L=1
      DO 151 I=1,NR
      IF(LP-1)162,163,163
  162 IF(I.EQ.1) GO TO 152
      IF(I.EQ.NR) GO TO 153
  164 RL(I)=(XPN(I+1)+XPN(I))*(XCORD(I+1)-XCORD(I))/4.+(XPN(I)+XPN(I-1))
     1*(XCORD(I)-XCORD(I-1))/4.
      GO TO 151
  152 RL(I)=(XPN(I+1)+XPN(I))*(XCORD(I+1)-XCORD(I))/4.
      L=L+1
      GO TO 151
  153 RL(I)=(XPN(I)+XPN(I-1))*(XCORD(I)-XCORD(I-1))/4.
      GO TO 151
  163 IF(XPN(I))154,154,156
  156 IF(L.EQ.1) GO TO 152
      IF(I.EQ.NR.OR.XPN(I+1).EQ.0.0) GO TO 153
      GO TO 164
  154 RL(I)=0.0
  151 CONTINUE
C   CALCULATION OF XWA AT EACH X STATION
      L=1
      DO 159 I=1,NR
      IF(LA-1)171,172,172
  171 IF(I.EQ.NR) GO TO 157
      IF(AWA(I).EQ.0.0) GO TO 177
  176 XWA(I)=(AWA(I+1)+AWA(I)+AWA(I-1)+AWA(I))/4.
      GO TO 159
  177 IF(AWA(I+1)-AWA(I))157,157,158
  157 XWA(I)=(AWA(I-1)+AWA(I))/2.
      GO TO 159
  158 XWA(I)=AWA(I+1)/2.+AWA(I)/2.
      L=L+1
      GO TO 159
  172 IF(AWA(I))174,174,173
  173 IF(L.EQ.1) GO TO 158
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      IF(I.EQ.NR.OR.AWA(I+1).EQ.0.0) GO TO 157
      GO TO 176
  174 XWA(I)=0.0
  157 CONTINUE
C     WRITE(3,22)
C     WRITE(3,15)(XCORD(I),XWA(I),RL(I),I=1,NR)
C   CALCULATION OF INCREMENTAL WSR , HPR , CPR
      M=NCOP-1
      DO 180 I=1,M
      DWSR(I)=WSR(I+1)-WSR(I)
      DHPR(I)=HPR(I+1)-HPR(I)
      DCPR(I)=CPR(I+1)-CPR(I)
  180 CONTINUE
C     WRITE(3,17)
C     WRITE(3,15)(DWSR(I),DHPR(I),DCPR(I),I=1,M)
C   CALCULATION OF CWSR , PCR , PL FOR EACH NODE POINT IN MESH
      DO 160 I=1,NR
      K=1
      DO 160 J=1,NC
      IF(YCORD(J).GT.XWA(I).OR.XWA(I).EQ.0.) GO TO 165
      CWSR(I,J)=YCORD(J)/XWA(I)
  170 IF(CWSR(I,J).LE.WSR(K+1)) GO TO 175
      K=K+1
      GO TO 170
  175 IF(XWA(I).LT.90.0) GO TO 185
      PCR(I,J)=CPR(K)+(CWSR(I,J)-WSR(K))*DCPR(K)/DWSR(K)
      GO TO 190
  185 PCR(I,J)=HPR(K)+(CWSR(I,J)-WSR(K))*DHPR(K)/DWSR(K)
  190 PL(I,J)=PCR(I,J)*RL(I)
      GO TO 160
  165 PCR(I,J)=0.
      PL(I,J)=0.
  160 CONTINUE
C     WRITE(3,18)
C     WRITE(3,6)((XCORD(I),YCORD(J),CWSR(I,J),PCR(I,J),PL(I,J),J=1,NC),I
C    1=1,NR)
C   CALCULATION OF ANL , AVL , TVL FOR EACH Y STATION ALONG X COORDINATE
      S=A*R
      DO 200 I=1,NR
      TVL(I)=0.
      DO 200 J=1,NC
      IF(J.EQ.NC) GO TO 230
      IF(J.EQ.1.AND.XWA(I).GE.YCORD(J+1)) GO TO 205
      IF(XWA(I).LT.YCORD(J+1).AND.J.EQ.1) GO TO 225
      IF(XWA(I).LE.YCORD(J).AND.PL(I,J+1).EQ.0.0) GO TO 230
      IF(PL(I,J+1).EQ.0.0.AND.XWA(I).GT.YCORD(J)) GO TO 235
      ANL(I,J)=S*((YCORD(J+1)-YCORD(J))*(PL(I,J+1)+PL(I,J))/(4.*COS(A*((
     1YCORD(J+1)+YCORD(J))/2.-YCORD(J))))+(YCORD(J)-YCORD(J-1))*(PL(I,J)
     2+PL(I,J-1))/(4.*COS(A*(YCORD(J)-(YCORD(J)+YCORD(J-1))/2.))))
      GO TO 215
  205 ANL(I,J)=S*((YCORD(J+1)-YCORD(J))*(PL(I,J+1)+PL(I,J))/4.)/COS(A*(Y
     1CORD(J+1)-YCORD(J))/2.)
      GO TO 215
  225 ANL(I,J)=S*(XWA(I)-YCORD(J))*(PL(I,J)/2.)*(1.-(XWA(I)-YCORD(J))/(2
     1.*(YCORD(J+1)-YCORD(J))))/COS(A*(XWA(I)-YCORD(J))/2.)
      GO TO 215
  230 ANL(I,J)=S*(XWA(I)-YCORD(J-1))*(PL(I,J-1)/2.)*(XWA(I)-YCORD(J-1))/
     1(2.*(YCORD(J)-YCORD(J-1)))*COS(A*(YCORD(J)-(XWA(I)+YCORD(J+1))/2.)
     2)
      GO TO 215
  235 ANL(I,J)=S*(YCORD(J)-YCORD(J-1))*(PL(I,J)+PL(I,J-1))/(4.*COS(A*(YC
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     1ORD(J)-(YCORD(J)+YCORD(J-1))/2.)))+(S*(XWA(I)-YCORD(J))*(PL(I,J)/2
     2.)*(1.-(XWA(I)-YCORD(J))/(2.*(YCORD(J+1)-YCORD(J)))))/COS(A*((XWA(
     3I)+YCORD(J))/2.-YCORD(J)))
  215 AVL(I,J)=ANL(I,J)*COS(A*YCORD(J))
      TVL(I)=TVL(I)+AVL(I,J)
  200 CONTINUE
C     WRITE(3,19)
C     WRITE(3,6)((XCORD(I),YCORD(J),ANL(I,J),AVL(I,J),TVL(I),J=1,NC),I=1
C    1,NR)
C   PUNCHED OUTPUT OF PRESSURE LOADS AT NODE POINTS
      IF(KO-1)405,425,960
  405 DO 400 I=1,NR
      DO 400 J=1,NC
      IF(ANL(I,J).EQ.0.0) GO TO 400
      IF(J.EQ.NC) GO TO 435
      ANL(I,J)=-ANL(I,J)
      GO TO 420
  435 ANL(I,J)=-ANL(I,J)/2.
      GO TO 420
  420 PUNCH 25,ANL(I,J),I,J,Z
  400 CONTINUE
      GO TO 650
C   CALCULATION OF NORMAL STRAP REACTION LOADS
  960 DO 900 I=1,NR
      IF(TVL(I).EQ.0.0) GO TO 905
      STRAP(I)=TVL(I)/SIN(A*(180.-ANGLE))
      REACT(I)=-STRAP(1)/R
      GO TO 900
  905 REACT(I)=0.0
      STRAP(I)=0.0
  900 CONTINUE
      DO 950 I=1,NR
      DO 950 J=1,NC
      IF(REACT(I).EQ.0.0) GO TO 950
      IF(J.EQ.NC) GO TO 945
      IF(YCORD(J).GE.ANGLE) GO TO 935
      ANIL(I,J)=0.0
      GO TO 950
  935 IF(YCORD(J).EQ.ANGLE) GO TO 930
      ANIL(I,J)=S*REACT(I)*((YCORD(J+1)-YCORD(J))/(2.*COS(A*((YCORD(J+1)
     1+YCORD(J))/2.-YCORD(J))))+(YCORD(J)-YCORD(J-1))/(2.*COS(A*(YCORD(J
     2)-(YCORD(J)+YCORD(J-1))/2.))))
      GO TO 940
  930 ANIL(I,J)=S*REACT(I)*(YCORD(J+1)-YCORD(J))/(2.*COS(A*(YCORD(J+1)-Y
     1CORD(J))/2.))
      GO TO 940
  945 ANIL(I,J)=S*REACT(I)*(YCORD(J)-YCORD(J-1))/(2.*COS(A*(YCORD(J)-YCO
     1RD(J-1))/2.))
  940 PUNCH 25,ANIL(I,J),I,J,Z
  950 CONTINUE
      GO TO 405
C   CALCULATION OF VIL , ANIL , ATIL FOR EACH  Y STATION
  425 PI=3.14159265359
      HC=THETA*PI*R/180.
      DO 600 I=1,NR
      TVIL(I)=0.
      DO 600 J=1,NC
      IF(TVL(I).EQ.0.0) GO TO 620
      IF(J.EQ.1) GO TO 605
      IF(J.EQ.NC) GO TO 610
```

```
      VIL(I,J)=S*(YCORD(J+1)-YCORD(J-1))*TVL(I)/(2.*HC)
      GO TO 615
  605 VIL(I,J)=S*(YCORD(J+1)-YCORD(J))*TVL(I)/(2.*HC)
      GO TO 615
  610 VIL(I,J)=S*(YCORD(J)-YCORD(J-1))*TVL(I)/(2.*HC)
  615 ANIL(I,J)=VIL(I,J)*COS(A*YCORD(J))
      ATIL(I,J)=-VIL(I,J)*SIN(A*YCORD(J))
      GO TO 625
  620 ANIL(I,J)=0.0
      ATIL(I,J)=0.0
  625 TVIL(I)=TVIL(I)+VIL(I,J)
  600 CONTINUE
C     IF(KO)650,650,640
C 640 WRITE(3,23)
C     WRITE(3,6)((XCORD(I),YCORD(J),VIL(I,J),ANIL(I,J),ATIL(I,J),J=1,NC)
C    1,I=1,NR)
  650 STVL=0.
      STVLXC=0.
      STVIL=0.
C   CALCULATION OF HALF STVL , STVLXC , TVLXC , STVIL
      DO 250 I=1,NR
      TVLXC(I)=TVL(I)*XCORD(I)
      STVL=STVL+TVL(I)
      STVIL=STVIL+TVIL(I)
      STVLXC=STVLXC+TVLXC(I)
  250 CONTINUE
C     WRITE(3,20)
C     WRITE(3,5)(XCORD(I),TVL(I),TVLXC(I),I=1,NR)
C   CALCULATION OF TOTAL PRESSURE LOAD ON VEHICLE AND CENTER OF PRESSURE
      CP=STVLXC/STVL
      S2TVL=2.*STVL
C     WRITE(3,21)STVL,STVLXC,S2TVL,CP
      PUNCH 28,S2TVL,CP
C   INERTIA LOADING BALANCES TOTAL VERTICAL PRESSURE LOAD CHECK
      UB=STVL-STVIL
C     WRITE(3,24)UB
      IF(KO-1)670,660,670
C   CALCULATION OF NET NORMAL AND TANGENTIAL LOADS AT A MESH POINT
  660 DO 700 I=1,NR
      DO 700 J=1,NC
      IF(TVL(I).EQ.0.0) GO TO 700
      IF(J.EQ.NC) GO TO 710
      ANL(I,J)=-ANL(I,J)+ANIL(I,J)
      ATIL(I,J)=ATIL(I,J)
      GO TO 700
  710 ANL(I,J)=1.*ANIL(I,J)-ANL(I,J)/2.
      ATIL(I,J)=1.*ATIL(I,J)
  700 CONTINUE
C     WRITE(3,26)
C     WRITE(3,27)((XCORD(I),YCORD(J),ANL(I,J),ATIL(I,J),J=1,NC),I=1,NR)
C   PUNCHED OUTPUT OF NET PRESSURE AND INERTIA LOADS.
      DO 800 I=1,NR
      DO 800 J=1,NC
      PUNCH 25,ANL(I,J),I,J,Z
      PUNCH 25,ATIL(I,J),I,J,Y
  800 CONTINUE
  670 IF(Y.EQ.TNT) GO TO 500
      GO TO 29
  500 CALL EXIT
      END
```

LISTING OF INPUT DATA CARDS FOR THE 3 SUPPLEMENTAL PROBLEMS

```
3.0
 3   10    1    1    0
0.0        0.0        0.0        3.47915   15.0       1.0
6.95834   60.0        0.17778
0.0        1.0        0.0        0.11111    0.98481   0.0
0.22222    0.93969    0.0        0.33333    0.86603   0.0
0.44444    0.76604    0.0        0.55555    0.64279   0.0
0.66666    0.5        0.0        0.77777    0.34202   0.0
0.88888    0.17365    0.0        1.0        0.0       0.0
25.0       1.0       60.0       60.0       60.0      835.0       90.0
21   19
 3   10    1    1    0
0.0       15.0        1.0        3.47916   60.0       0.17778
6.95834    0.0        0.0
0.0        1.0        0.0        0.11111    0.98481   0.0
0.22222    0.93969    0.0        0.33333    0.86603   0.0
0.44444    0.76604    0.0        0.55555    0.64279   0.0
0.66666    0.5        0.0        0.77777    0.34202   0.0
0.88888    0.17365    0.0        1.0        0.0       0.0
25.0       2.0       60.0       60.0       60.0      835.0       90.0
21   19
 4   10    1    1    0
0.0        0.0        0.0        1.73958   15.0       1.0
5.21875   60.0        0.17778    6.95834    0.0       0.0
0.0        1.0        0.0        0.11111    0.98481   0.0
0.22222    0.93969    0.0        0.33333    0.86603   0.0
0.44444    0.76604    0.0        0.55555    0.64279   0.0
0.66666    0.5        0.0        0.77777    0.34202   0.0
0.88888    0.17365    0.0        1.0        0.0       0.0
25.0       3.0       60.0       60.0       60.0      835.0       90.0
21   19
```

LISTING OF PUNCHED LOAD CARDS FOR THE 3 SUPPLEMENTAL PROBLEMS

-1.24[illegible]	11	1	1
-2.230E+03	11	2	1
-1.522E+03	11	3	1
-6.269E+02	11	4	1
-2.692E+01	11	5	1
-2.406E+03	12	1	1
-4.423E+03	12	2	1
-3.328E+03	12	3	1
-1.751E+03	12	4	1
-3.595E+02	12	5	1
-2.223E+03	13	1	1
-4.207E+03	13	2	1
-3.521E+03	13	3	1
-2.464E+03	13	4	1
-1.210E+03	13	5	1
-1.883E+02	13	6	1
-2.018E+03	14	1	1
-3.882E+03	14	2	1
-3.435E+03	14	3	1
-2.731E+03	14	4	1
-1.820E+03	14	5	1
-8.402E+02	14	6	1
-9.647E+01	14	7	1
-1.807E+03	15	1	1
-3.509E+03	15	2	1
-3.208E+03	15	3	1
-2.729E+03	15	4	1
-2.094E+03	15	5	1
-1.341E+03	15	6	1
-5.801E+02	15	7	1
-4.688E+01	15	8	1
-1.591E+03	16	1	1
-3.110E+03	16	2	1
-2.991E+03	16	3	1
-2.569E+03	16	4	1
-2.127E+03	16	5	1
-1.591E+03	16	6	1
-9.832E+02	16	7	1
-3.951E+02	16	8	1
-2.095E+01	16	9	1
-1.373E+03	17	1	1
-2.697E+03	17	2	1
-2.553E+03	17	3	1
-2.321E+03	17	4	1
-2.008E+03	17	5	1
-1.626E+03	17	6	1
-1.188E+03	17	7	1
-7.084E+02	17	8	1
-2.632E+02	17	9	1
-8.241E+00	17	10	1
-1.152E+03	18	1	1

-2.271E+03	18	2	1
-2.173E+03	18	3	1
-2.013E+03	18	4	1
-1.796E+03	18	5	1
-1.528E+03	18	6	1
-1.216E+03	18	7	1
-8.707E+02	18	8	1
-5.005E+02	18	9	1
-1.702E+02	18	10	1
-2.631E+00	18	11	1
-9.298E+02	19	1	1
-1.836E+03	19	2	1
-1.769E+03	19	3	1
-1.660E+03	19	4	1
-1.513E+03	19	5	1
-1.331E+03	19	6	1
-1.118E+03	19	7	1
-8.785E+02	19	8	1
-6.177E+02	19	9	1
-3.416E+02	19	10	1
-1.054E+02	19	11	1
-5.730E-01	19	12	1
-7.068E+02	20	1	1
-1.398E+03	20	2	1
-1.354E+03	20	3	1
-1.285E+03	20	4	1
-1.191E+03	20	5	1
-1.074E+03	20	6	1
-9.332E+02	20	7	1
-7.734E+02	20	8	1
-5.990E+02	20	9	1
-4.131E+02	20	10	1
-2.189E+02	20	11	1
-6.102E+01	20	12	1
-5.000E-02	20	13	1
-2.976E+02	21	1	1
-5.891E+02	21	2	1
-5.721E+02	21	3	1
-5.454E+02	21	4	1
-5.089E+02	21	5	1
-4.625E+02	21	6	1
-4.071E+02	21	7	1
-3.445E+02	21	8	1
-2.760E+02	21	9	1
-2.023E+02	21	10	1
-1.245E+02	21	11	1
-5.124E+01	21	12	1
-3.365E+00	21	13	1
252742.17			615.94
-1.242E+03	1	1	1
-2.230E+03	1	2	1
-1.522E+03	1	3	1
-6.269E+02	1	4	1
-2.691E+01	1	5	1
-2.406E+03	2	1	1
-4.423E+03	2	2	1
-3.328E+03	2	3	1
-1.751E+03	2	4	1
-3.594E+02	2	5	1
-2.223E+03	3	1	1
-4.207E+03	3	2	1

-3.521E+03	3	3	1
-2.464E+03	3	4	1
-1.210E+03	3	5	1
-1.883E+02	3	6	1
-2.018E+03	4	1	1
-3.682E+03	4	2	1
-3.435E+03	4	3	1
-2.731E+03	4	4	1
-1.820E+03	4	5	1
-8.402E+02	4	6	1
-9.647E+01	4	7	1
-1.807E+03	5	1	1
-3.509E+03	5	2	1
-3.208E+03	5	3	1
-2.729E+03	5	4	1
-2.094E+03	5	5	1
-1.341E+03	5	6	1
-5.801E+02	5	7	1
-4.688E+01	5	8	1
-1.591E+03	6	1	1
-3.110E+03	6	2	1
-2.901E+03	6	3	1
-2.569E+03	6	4	1
-2.127E+03	6	5	1
-1.591E+03	6	6	1
-9.832E+02	6	7	1
-3.951E+02	6	8	1
-2.095E+01	6	9	1
-1.373E+03	7	1	1
-2.697E+03	7	2	1
-2.553E+03	7	3	1
-2.321E+03	7	4	1
-2.008E+03	7	5	1
-1.626E+03	7	6	1
-1.188E+03	7	7	1
-7.084E+02	7	8	1
-2.632E+02	7	9	1
-8.242E+00	7	10	1
-1.152E+03	8	1	1
-2.271E+03	8	2	1
-2.173E+03	8	3	1
-2.013E+03	8	4	1
-1.796E+03	8	5	1
-1.528E+03	8	6	1
-1.216E+03	8	7	1
-8.707E+02	8	8	1
-5.005E+02	8	9	1
-1.702E+02	8	10	1
-2 631E+00	8	11	1
-9.298E+02	9	1	1
-1.836E+03	9	2	1
-1.769E+03	9	3	1
-1.660E+03	9	4	1
-1.513E+03	9	5	1
-1.331E+03	9	6	1
-1.118E+03	9	7	1
-8.785E+02	9	8	1
-6.177E+02	9	9	1
-3.416E+02	9	10	1
-1.054E+02	9	11	1

-5.732E-01	9	12	1
-7.068E+02	10	1	1
-1.398E+03	10	2	1
-1.354E+03	10	3	1
-1.285E+03	10	4	1
-1.191E+03	10	5	1
-1.074E+03	10	6	1
-9.332E+02	10	7	1
-7.734E+02	10	8	1
-5.990E+02	10	9	1
-4.131E+02	10	10	1
-2.189E+02	10	11	1
-6.102E+01	10	12	1
-5.003E-02	10	13	1
-2.976E+02	11	1	1
-5.891E+02	11	2	1
-5.721E+02	11	3	1
-5.453E+02	11	4	1
-5.089E+02	11	5	1
-4.625E+02	11	6	1
-4.071E+02	11	7	1
-3.445E+02	11	8	1
-2.760E+02	11	9	1
-2.023E+02	11	10	1
-1.245E+02	11	11	1
-5.124E+01	11	12	1
-3.365E+00	11	13	1
252741.61			198.44
-1.242E+03	6	1	1
-2.230E+03	6	2	1
-1.522E+03	6	3	1
-6.269E+02	6	4	1
-2.691E+01	6	5	1
-2.406E+03	7	1	1
-4.423E+03	7	2	1
-3.328E+03	7	3	1
-1.751E+03	7	4	1
-3.594E+02	7	5	1
-2.223E+03	8	1	1
-4.207E+03	8	2	1
-3.521E+03	8	3	1
-2.464E+03	8	4	1
-1.210E+03	8	5	1
-1.883E+02	8	6	1
-2.018E+03	9	1	1
-3.882E+03	9	2	1
-3.435E+03	9	3	1
-2.731E+03	9	4	1
-1.820E+03	9	5	1
-8.402E+02	9	6	1
-2.647E+01	9	7	1
-1.807E+03	10	1	1
-3.509E+03	10	2	1
-3.208E+03	10	3	1
-2.729E+03	10	4	1
-2.094E+03	10	5	1
-1.341E+03	10	6	1
-5.801E+02	10	7	1
-4.688E+01	10	8	1
-1.591E+03	11	1	1
-3.110E+03	11	2	1

-2.901E+03	11	3	1
-2.569E+03	11	4	1
-2.127E+03	11	5	1
-1.591E+03	11	6	1
-9.832E+02	11	7	1
-3.951E+02	11	8	1
-2.095E+01	11	9	1
-1.373E+03	12	1	1
-2.697E+03	12	2	1
-2.553E+03	12	3	1
-2.321E+03	12	4	1
-2.008E+03	12	5	1
-1.626E+03	12	6	1
-1.188E+03	12	7	1
-7.084E+02	12	8	1
-2.632E+02	12	9	1
-8.241E+00	12	10	1
-1.152E+03	13	1	1
-2.271E+03	13	2	1
-2.173E+03	13	3	1
-2.013E+03	13	4	1
-1.796E+03	13	5	1
-1.528E+03	13	6	1
-1.216E+03	13	7	1
-8.707E+02	13	8	1
-5.005E+02	13	9	1
-1.702E+02	13	10	1
-2.631E+00	13	11	1
-9.298E+02	14	1	1
-1.836E+03	14	2	1
-1.769E+03	14	3	1
-1.660E+03	14	4	1
-1.513E+03	14	5	1
-1.331E+03	14	6	1
-1.118E+03	14	7	1
-8.785E+02	14	8	1
-6.177E+02	14	9	1
-3.416E+02	14	10	1
-1.054E+02	14	11	1
-5.731E-01	14	12	1
-7.068E+02	15	1	1
-1.398E+03	15	2	1
-1.354E+03	15	3	1
-1.285E+03	15	4	1
-1.191E+03	15	5	1
-1.074E+03	15	6	1
-9.332E+02	15	7	1
-7.734E+02	15	8	1
-5.990E+02	15	9	1
-4.131E+02	15	10	1
-2.189E+02	15	11	1
-6.102E+01	15	12	1
-5.001E-02	15	13	1
-2.976E+02	16	1	1
-5.891E+02	16	2	1
-5.721E+02	16	3	1
-5.454E+02	16	4	1
-5.089E+02	16	5	1
-4.625E+02	16	6	1
-4.071E+02	16	7	1
-3.445E+02	16	8	1

-2.760E+02	16	9	1
-2.023E+02	16	10	1
-1.245E+02	16	11	1
-5.124E+01	16	12	1
-3.365E+00	16	13	1
252741.83			407.19